GAS JOURNAL

LIGHT ⁘ HEAT ⁘ POWER ⁘ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

PROPRIETORS: WALTER KING, LIMITED. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

Telephone: Central 6055. —— Telegrams: "GASKING, FLEET, LONDON."

VOL. CLXXXV., No. 3434.] WEDNESDAY, MARCH 13, 1929. [81ST YEAR.

Editorial Notes.

Past, Present, and Future.

IT is well, while never forgetting that our main purpose is to push forward, to pause now and again and take a glance backwards, in order to gauge the extent of the road that has been traversed. It is well, that is to say, if the result of such a scrutiny of the past is to encourage us to further efforts. It is not well if the result is to make us so satisfied with what has been accomplished as to rob us of desire to proceed. The road behind lies open to our gaze; but not so the road in front. Finality is far ahead, right out of sight, and doubtless always will be; yet having gone so far, we must go farther. The gas industry could not maintain its position as it does, did it not progress; for a business if it is not going forward is going back. But progress, after all, from a practical point of view, is of value only in a relative sense; it must at least be equal, if it be not even superior, to progress made by others working on parallel, or competing, lines.

Such thoughts as these passed through one's mind during last Thursday's meeting of the Midland Association of Gas Engineers and Managers, when Mr. C. M. D. Belton (Engineer, Manager, and Secretary of the Shrewsbury Gas Light Company) delivered his Presidential Address, and Mr. William Wilson (Engineer to the Burton-on-Trent Corporation) opened a discussion upon the question of whether our manufacturing methods are progressing. Mr. Belton took his hearers back more than a century, to the day at the beginning of 1820 when the Mayor convened a meeting for the purpose of considering the expediency of lighting Shrewsbury with gas. He quoted from the first page of the original minute book, and added: "Then follow many pages giving a detailed "account of the rough, rock-strewn path of progress "followed by these provincial pioneers, with several il- "luminating sidelights upon the difficulties encountered." These difficulties were as numerous as they were great; but the gas industry did not, from its very earliest days, lack men who were capable of overcoming them. It does not lack them now; and from the training that is available, and the young men whom we see around us, we do not believe that it will lack them in the future.

But no effort must be relaxed; no time can be spared for self-congratulation. Progress is, of course, being made continuously in one department or another of gas-works practice; but is it rapid enough to keep the industry well ahead of competitors who are also making big strides? This is the point to which Mr. Wilson was desirous of drawing the attention of the meeting; and if his picture was drawn a little on the dark side, the keenness of his desire to stress the importance of his subject afforded sufficient reason. In the address which he had read earlier in the proceedings, Mr. Belton showed by figures from the Board of Trade Returns the progress which the industry has made on the commercial side during recent years, along with the improved methods which have been adopted in various processes of manufacture. But he also indicated how vastly greater the business could probably be under conditions more favourable to development. Comparing the latest Return with that of twenty years ago, it seems that the total number of consumers has increased by 62 p.ct., and the total gas sold by 67 p.ct.; but the average consumption per consumer has only risen from 31,120 c.ft. to 32,260 c.ft., equivalent to 3·68 p.ct. increase. Both these figures, it should be noted, include the consumption by public lamps. Over the past eight years (during which period only have the separate figures been available), there has been an increase of 1·44 p.ct. in the average consumption per customer. Here, then, is waiting to be won the reward for redoubled effort—namely, a further increase in the most profitable business of all, which is that represented by additional supplies of gas to existing consumers. With the ever-increasing uses to which gas is being put, a far larger average consumption should be attainable; and to the fact that it has not so far been attained one would expect Mr. Wilson to point as evidence of the soundness of his contention that progress has been unduly slow. He was referring particularly to progress in manufacturing methods; but that was not the only direction in which the adoption of new methods in place of old was urged at the meeting.

Halifax and the Two-Part Tariff.

THE Presidential Address of Mr. W. B. McLusky at the recent meeting of the Manchester District Institution of Gas Engineers provoked an interesting and profitable discussion. The subject of multi-part tariffs may be regarded as one of the most important now before the gas industry: and no worker in the industry is better qualified to deal with the matter than the new President of the Manchester

Institution. It has become the custom to discuss American methods and quote American examples, in view of the thoroughness with which tariffs have been investigated and developed in the United States, and in consequence of the very large number of towns in that country and Canada which have abandoned the flat rate; and we are apt to forget that in this country is to be found the origin of the two-part charge. As far back as 1892, Messrs. Anderson Bros. put into operation a two-part tariff, and in 1903 (as Mr. Ingham pointed out in the discussion on the Presidential Address) Mr. McLusky drew attention to "the burden of fixed charges" which imposed unfair charges on certain classes of business. It will not be denied that the American gas industry was not interested in multi-part tariffs as far back as the dates mentioned. There are, however, two very important differences between the systems as introduced and practised in this country compared with America. In practically every case in America the particular multi-part tariff adopted is the only one in operation, and therefore compulsory; whereas, in every case in England up to the present, it is optional. Further, in no case in America is the standing charge or service charge based on an arbitrary standard such as floor area or rateable value. At the same time it must be agreed that the American gas industry has carried the system far beyond the scope of the early ideas, both in principle and in application.

It will be of interest to examine for a moment one of Mr. McLusky's arguments in 1903 (see the "Journal," April 21, 1903, p. 149). He states: "If a consumer contributes 1s. 6d. per 1000 c.ft. for interest and sinking funds alone on the gas which he consumes in his private dwelling, or for the lighting of his business premises, is it fair to tax him again to the same extent on the gas used for cooking, heating, or power purposes? Certainly not." We would qualify this reply by adding, "if the load in the second category is not coincident with the lighting load in his home or business premises;" but very few would agree that if the loads were coincident, the consumer would be entitled to escape any part of the interest and sinking fund charges, seeing that the capital has been provided for the laying-down of the works and distribution plant to cope with the maximum requirement. This reference is sufficient to show how the scope of the two-part tariff has enlarged since the early days.

The most important aspect of the discussion was the almost complete unanimity of the members that some new method of gas charge must be devised in order to meet the competition of other fuels. This aspect is, of course, important; but it envisages effects rather than the elimination of anomalies. In our opinion a two-part tariff is essential for three principal reasons:

1. The elimination of the unprofitable consumer.
2. The reduction of price to consumers who are entitled to such reduction, and
3. Development of the business.

The last of these reasons naturally introduces the question of competition, and the three considerations must be taken conjointly. Mr. McLusky has a long and varied experience in the effect of his own and other two-part tariffs; but it must not be forgotten that his tariff is an optional one and, although his system of standard requirement based on floor area forms a very good working basis, yet the experience gained would not necessarily be of value in a compulsory two or three part charge based on the actual cost to the gas undertakings of different groups of consumers. The Halifax system, however, has fully justified its introduction, and has had the effect of largely increasing the sale per consumer; further, it automatically gives a lower price of gas to consumers who have been encouraged to increase consumption. To this extent, two of the requirements have been met, but none of the existing multi-part tariffs in England can eradicate the unprofitable consumer. This is not peculiar to England. Many of the American undertakings, after making a careful survey of all classes of consumers and calculating a scientific rate base as nearly as possible on the cost of supply, find that it is impossible to put into operation such a rate, because of the very high cost per 1000 c.ft. which the small consumers would be called upon to pay. Fortunately they are assisted by overwhelming evidence that in the majority of cases the small consumer is not the poor man. He is usually the man who uses gas purely as a convenience and during very limited periods. In this country there are at present insufficient data to form any definite conclusion regarding this point.

The Rate Structure Problem.

In considering the question of what is a scientific rate, it must not be overlooked that costing is not an exact science, and certain elements in the cost must be settled by compromise; therefore any logically constructed rate can only be the best which can be framed, having regard to all the known circumstances. There is no doubt that, in this country, the time is not politically ripe for a compulsory universal multi-part tariff calculated to make each group of consumers pay its just proportion of charges; and even if it were, many gas undertakings would shrink from the idea of putting it into operation. In the Second Report of the National Fuel and Power Committee, this question was considered, and the following was the conclusion of the Committee:

> "We are of opinion that the two-part tariff system of charge is calculated to lead to more advantageous working and is, in the long run, the fairest method of charge. We consider, however, that, if the Board of Trade are authorized to sanction the introduction of two-part tariff systems, due regard should be had by them to the necessity for affording sufficient protection for small consumers, and that, while it is obvious that the present method of regulating dividends according to the price of gas to the ordinary consumer needs to be amended, authority to introduce a two-part tariff must not be accompanied by the removal of control over dividends paid."

It is held by some that companies working under basic price Acts are in a position to institute any form of multi-part tariff. Though this is probably true in some cases, yet the limitation of charge in relation to dividend which is imposed in the South Suburban Act, for example, to a great extent rules a practical multi-part tariff out of court. Municipal undertakings also are in a position to introduce a two-part tariff in cases where the maximum price authorized is sufficiently above the flat rate selling price, but clearly the scope is limited. The electrical industry is not unanimous in regard to the basis of two-part tariffs; and the report of the Committee which was constituted to investigate the matter indicates the difficulties arising when an attempt is made to prepare a scheme for universal application. In the gas industry there is no desire to have the wide variations of price existing to-day in the electrical world, where the highest rate may be more than twelve times the lowest, and the lowest in some cases fails to meet the cost of fuel and labour. As one of the speakers in the discussion on the address pointed out, the user of additional current (whether with additional apparatus or not) comes to look upon the cost of current as the "commodity" element only, and herein lies an argument of very great advertising value, which is pushed for all it is worth by our competitors.

Another interesting point discussed related to the charges for stove and meter rents. There is little doubt that in any rational tariff the meter rent should be incorporated in the fixed portion of the charge (varied, if necessary, according to size or demand) and that the hire of appliances should be self-supporting outside the ambit of the tariff. The slot meters will cause considerable difficulty in any scale of charging; but an equitable scheme should not be beyond the capacity of our governing body. In any case a graded system would be a distinct improvement on the present method.

The gas industry must not let the matter rest where it is. A departure from the flat rate is overdue, and the present system is a heavy handicap on the development of gas sales for industrial purposes. The present scale of discounts is insufficient to meet the competition of other fuels; and Mr. McLusky deserves the thanks of his colleagues throughout the kingdom for giving them the benefit of his experience and detailed investigation, and for affording his listeners the opportunity of what proved to be an interesting and profitable discussion.

Complete Gasification.

ATTENTION is directed to a descriptive article on Humphreys & Glasgow's new complete gasification plant which is published in to-day's "JOURNAL." It appears at an opportune moment, for the winter of 1928-29, the coldest recorded since the memorable one of 1894-95, has emphasized in extraordinary fashion the necessity of having gas-making plant of great flexibility. Nor is this necessity likely to decrease in the future, though it be granted that winters of similar severity to that through which we have just passed are unlikely to recur at regular intervals. The point to bear in mind is that published figures relating to the increased sales of gas year by year do not afford a criterion by which the reserve of gas producing and storage plant can be accurately assessed. This would be true only if the number of appliances installed on the district showed an increase in direct simple ratio to the growth in gas sales. In fact, however—as has been so clearly proved during the past two months—the apparatus already fixed in consumers' premises provides a potential demand far in excess of normal economic gas production, a demand which may at any time give rise to considerable anxiety in its satisfactory fulfilment.

In general, then, the time has obviously arrived when gas undertakings must have at their disposal either a large reserve of storage capacity (which implies, of course, much idle capital) or a large reserve of gas-making plant which can be brought into full operation at a moment's notice. Choice of the latter unit, as in most matters relating to efficient gas supply, depends primarily on local circumstances; but there may be many instances where a reliable complete gasification plant would prove advantageous from all points of view. The capital charges of such a plant are comparatively low; maintenance expenses are negligible; the ground space occupied in relation to gas output is at a minimum; and such a plant can be brought into full working within a couple of hours. In this regard the new Humphreys & Glasgow plant merits the closest attention. It has been in actual operation at the works of the North Middlesex Gas Company for 450 days; it has dealt successfully with many types of coal; it worked smoothly, efficiently, and at maximum output during the cold spell—when the position in the district, Mr. Lawrie Trewby, Engineer and Manager of the Company, explained, would have been different had there been the slightest failure—in short, its virtues have been such that another unit is to be installed shortly at North Middlesex.

Results of tests carried out by Dr. H. G. Colman and by the firm are published in detail on later pages of this issue. These tests, of necessity, were of short duration; but the long total period during which the plant has been in practical everyday use has afforded proof of its simple, quiet, and cleanly operation, efficient carbonization, easy clinkering, and general mechanical efficiency. The period, too, has been sufficient to show that the wear and tear on that part of the plant for the carbonization of coal is low. The outstanding feature of the plant, however, is undoubtedly its flexibility. Though producing coal gas to the extent of 20 to 25 p.ct. of the total make, it has the elasticity and other collateral advantages of standard carburetted water gas plant; and—in common with all types of complete gasification units—as the specific gravity of the mixed gas (without oil carburetting) is less than that of standard carburetted water gas of the same calorific value, a wider range of admixture in the town supply is practicable. In other words, the plant provides peak-load coal gas, without appreciable additional expense, as well as peak-load water gas—carburetted or not, as may be required. Moreover, the efficiency is good whether coal or coke is used exclusively. Tests have demonstrated that, when operating on coke alone, this combination unit will make blue or carburetted water gas with a capacity and oil efficiency equal to those of a standard carburetted water gas generator of the same size, and with even higher generator fuel efficiency, owing to the fact that the coke, before reaching the gasification zone, is dried and preheated by the exit back-run gases. The temperature of these gases is thereby reduced, and this means a saving not only in generator fuel, but also in condensing capacity and costs. A few of the advantages pertaining to complete gasification as such are given in the article, which also includes a summary of the method of operation of the Humphreys & Glasgow plant.

Big Consumptions

In an address preceding the opening of a new ambulance station at Beckton last week, Sir David Milne-Watson, the Governor of the Gas Light and Coke Company, quoted the record outputs of gas achieved during the recent cold spell. It appears that the heaviest month's output previously recorded was that for December, 1927, when the Company sent out 5778 million c.ft., an average of 186 million c.ft. per day. In January last, they sent out 6046 millions, and in the short and much lighter month of February 5708 millions, or 204 millions per day. In the seven days ended Feb. 18, the output was 1587 million c.ft.—against a previous best of 1445 millions in Christmas shopping week, 1927. On Friday, Feb. 15, London took no less than 240,543,000 c.ft. from the Company's mains; whereas until this year the record day's output had been 225,873,000 c.ft. on Dec. 20, 1927. Thus the Company have had the highest day's output, the highest week's output, and the highest month's output during the recent spell of abnormal frost.

And Small Consumptions.

We have been referring above to enormous figures of gas consumption during last month; but there is also an aspect of small consumptions which is worthy of note in the same connection. Stories of bitter inconvenience—and perhaps worse where domestic water supplies became frozen up—are coming to light now; and they are all the more regrettable when one reflects that in numberless instances the catastrophe could have been easily avoided, as in many others it was. Water supply has always been a vulnerable point. In early history we learn how eager, when investing a town, the besiegers were to cut off the water supply; and in the modern home the supply of water is, at any rate, no less vital. What "freezing-up" means to the unfortunate inmates, there is no need here to detail. Suffice it to say that it would be worth a good deal to assure its avoidance. Yet it does not always require a "good deal" to secure freedom from this trouble. One or two gas burners left alight just at the spot where attack is most likely have frequently kept things going, and have enabled the happy possessors to smile at neighbours who had not "gas laid on." This is a small consumption with a big effect.

The Technical Press.

In so far as his reference was to us—and it seems that it touched the "JOURNAL" very closely—we desire to bow our acknowledgment of the compliment which Mr. C. M. D. Belton paid the Technical Press at the close of his Presidential Address to the Midland Association of Gas Engineers and Managers. It is always pleasing to know that one's efforts are appreciated; and Mr. Belton leaves no doubt whatever on this score. The field which he finds so well covered is a wide one, and is becoming even wider. In dealing with everything which calls for notice, we frequently find ourselves up against the limits both of postal facilities and of human endeavour. But the encouragement which we receive, alike from subscribers and from advertisers, determines us to persevere, even though it does not relax the postal regulations.

Universality of Heat.

Towns with few factories, or none, are apt to envy others which may be differently situated in this respect; but new uses for gas may always be sought. It would be interesting to ascertain exactly how few manufacturing processes there are into which heat does not enter.

Waste Not.

Wasteful gas consumption must have mischievous effects all round. Therefore there is reason in the argument ad-

vanced at the recent Birmingham conference that, by seeing that gas is properly used, the industry helps itself as well as the consumers.

The Gas Section.

Speaking of Birmingham, reminds us that last year in the Gas Section of the British Industries Fair there were 57 firms exhibiting, and occupying a stand space of 16,000 sq. ft. This year the area of the stand space was just over 19,500 sq. ft., which was allotted to the display of the manufactures of 70 firms. There is solid ground for satisfaction here.

Municipal Trading.

There appeared, in a recent issue of "The Times," a letter signed by a number of Members of Parliament calling attention to the increasing number of local authorities engaged in, and endeavouring to engage in, speculative municipal trading. In the opinion of the signatories, it is time a halt was called. There have been many instances in which a halt should have been called long ago, though among them we do not include the supply of gas, which is practically free of the speculative element, and water, which is essential to sustain life. Many trading concerns can be far better carried on by private enterprise; and in connection with these there is no sound reason for the risking of ratepayers' money. While there is a dire need of retrenchment in all directions, anything which may possibly lead to a further increase of the already far too heavy burden of rates should be closely scrutinized before being adopted. The days when needless expenditure could be undertaken by local authorities with a light heart are gone—not to return for generations to come.

FORTHCOMING ENGAGEMENTS.

[Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.]

March 15.—Southern Association of Gas Engineers and Managers.—Meeting at the Hotel Cecil at 2.15 p.m.

March 16.—Wales and Monmouthshire Junior Gas Association.—Meeting at Neath. Paper by Mr. J. W. Thomas.

March 20.—Southern Association of Gas Engineers and Managers (Eastern District).—Meeting.

March 20.—Manchester and District Junior Gas Association.—Joint visit with Yorkshire Junior Gas Association to the New Sharlston Collieries Co., Ltd., Crofton; and to Messrs. Geo. Craddock & Co., Ltd., Wire Rope Works, Wakefield.

March 20.—Yorkshire Junior Gas Association.—See Manchester and District Junior Gas Association above.

March 21.—Southern Association of Gas Engineers and Managers (Eastern District).—Meeting.

March 22.—London and Southern District Junior Gas Association.—Meeting at the Westminster Technical Institute, S.W. 1. Paper by Mr. S. G. Watson.

March 23.—Scottish Junior Gas Association (Western District).—Visit to Dawsholm Gas-Works, Glasgow.

May 16.—Midland Association of Gas Engineers.—Visit to Shrewsbury.

May 24.—North of England Gas Managers' Association.—Annual Meeting.

Cornish Association of Gas Managers.—At the Annual Meeting of this Association held at Truro on March 6, Mr. H. H. Hoare, Engineer and Manager to the Falmouth Gas Company, was elected President for the ensuing year, and Mr. F. G. Kingwell was re-elected Hon. Secretary. The retiring President, Mr. S. J. Ingram, was unanimously thanked for his services during the past two years.

Technical Institutes and Education.—When reporting last week the Semi-Jubilee Celebration of the Western District Section of the Scottish Junior Gas Association, Mr. Robert Gray, of Kingston-upon-Thames, was made to say (p. 670) that in the revised Education Scheme of the Institution of Gas Engineers they still had the co-operation of the Westminster Technical Institute and the Board of Education. This should have read "of the Technical Institutes and the Board of Education."

AREA GAS SUPPLY COMMITTEE.

Dr. E. W. Smith's Appointment.

Dr. E. W. Smith, Technical Director of the Woodall-Duckham Companies, has been appointed Chief Technical Officer (unpaid) of the Area Gas Supply Committee of the Board of Trade, following the appeal by the President, the Right Hon. Sir Philip Cunliffe Lister, to the industries concerned that they should loan expert personnel for the work of the Committee. Dr. Smith will continue to act as Technical Director of the Companies with which he is associated; his work for the Committee taking up a portion of his time only.

The Area Gas Supply Committee is carrying out an investigation spread over the industrial areas between Liverpool and the Humber, and Leeds and Birmingham, in order to see if gas undertakings in that area can take a supply of gas from the coke ovens which already exist there, or which may be erected in the future.

SOCIETY OF BRITISH GAS INDUSTRIES.

Meeting of Council.

A meeting of the Council was held at 56, Victoria Street, Westminster, S.W., on Feb. 28; Mr. C. A. Goodall, Vice-Chairman, presiding in the absence of the Chairman, Mr. R. J. Milbourne, who was indisposed.

Those present were Messrs. T. A. Braddock, G. Clark, G. J. Jackson, A. H. Lymn, H. M. Thornton, Ernest West, Frank West, Col. E. A. Wilson, Dr. E. W. Smith (Hon. Treasurer), Mr. E. J. Davison (Hon. Secretary), and Mr. Arthur L. Griffith (Secretary). Apologies for absence were reported from Messrs. F. Dobson, D. M. Gibb, J. W. Scott, B. B. Waller, R. B. Hodgson, and F. J. Gould.

The Vice-Chairman extended a hearty welcome to Mr. Ernest West, the new Chairman of Section III.

Col. E. A. Wilson was nominated a member of the National Illumination Committee of Great Britain, in place of Mr. H. Talbot retired.

Mr. Philip H. Sugg was nominated the Society's representative on the following Sub-Committees: Factory, office, and school lighting; diffusing material; and light flux distribution.

The report of the Federation of British Industries for February was submitted. The only matter calling for attention was "South Africa proposed Commercial Treaty with Germany." It was resolved to write to the Federation saying that the Society support them in their action in protesting against the proposed Treaty.

British Engineering Standards Association.

Draft Specification for Tars for Road Purposes.

It was reported that a letter had been sent to the Association with comments on the draft Specification, which the Society considered very important. The Association have been asked to arrange, when the matter comes before the Committee, for one of the members of the Council to be present. This has now been agreed to, and Dr. Smith has been appointed as the representative.

WORLD POWER CONFERENCE.

Barcelona Sectional Meeting.

A Sectional Meeting of the World Power Conference on the Complete Utilization of Water Power Resources will be held at Barcelona, Spain, between May 15 and May 23, 1929, at the same time as the Barcelona Fair. It will be followed by official visits to places of interest in Spain. It is being organized by the Spanish National Committee of the World Power Conference, with the official co-operation of the Spanish Government.

The subjects to be dealt with will be:

(*a*) General hydrological problems.
(*b*) Technical problems of water power utilization.
(*c*) Economic and financial problems.
(*d*) Legal problems.
(*e*) Protective measures and defence works of undertakings.

The fee for ordinary membership of the Conference is 30 pesetas, or one pound sterling. Copies of the Technical Programme (in English, Spanish, French, and German), together with forms of application for Membership, may be obtained from: The Secretary, International Executive Council, Central Office, World Power Conference, 63, Lincoln's Inn Fields, London, W.C. 2.

PERSONAL.

Mr. JOHN STANDEN BIRD has been appointed Assistant Engineer and Manager to the Bromsgrove Gas Light and Coke Company. After leaving Bromsgrove School, he served 4½ years with Messrs. Drakes, Ltd., going through the workshops, on important outside contracts, and in the drawing office.

Mr. and Mrs. J. NEATH wish to thank their many friends for kind expressions of sympathy with them in their recent bereavement.

Mr. WILLIAM L. WOOD, who has completed fifty years' service with the Sunderland Gas Company as chief clerk and cashier, has been presented by the staff with an oak bureau and canteen of cutlery.

Mr. THOS. COOKE, A.M.I.Mech.E., has been elected to the Board of Directors of Messrs. T. F. & J. H. Braime, Ltd., the Pressed Steel and Engineering Works, Hunslet, Leeds. Mr. Cooke resigned the appointment as Works Manager with Messrs. Clayton, Son, & Co., Ltd., Structural Engineers and Boilermakers, of Hunslet, to take over the general management of Messrs. Braime's works a year ago, and succeeds as a Director the late Mr. G. Hewison, who was for 43 years with the Company up to the time of his death in December last.

OBITUARY.

WALTER FENDICK.

The long and faithful service of nearly forty years standing to the credit of Mr. Walter Fendick, Resident Engineer to the Hemel Hempstead Gas Company, was terminated with tragic suddenness by his death in a London nursing home on Feb. 28. He had undergone a serious operation, and was recovering so favourably that arrangements had been made for his return home on the very day when a relapse occurred, and the end came in the evening. He was 67 years of age. Previous to his appointment at Hemel Hempstead, he was Assistant Engineer to the Richmond Gas Company, under the late Mr. Thomas May. That undertaking was absorbed by the Gas Light and Coke Company a few years ago. Mr. Fendick had been a Member of the Institution of Gas Engineers since 1897, and was a regular attendant at the annual meetings.

The funeral took place on March 5 at Bourne End Cemetery, Boxmoor, and was attended by a large number of friends. The chief mourners were his sister and niece. A short service was held at the Gas-Works House by the Rev. H. H. Thompson, an ardent coadjutor with Mr. Fendick in the splendid work which he carried on at Boxmoor as Hon. Secretary and Treasurer of the Oxford Men's Club. Others at the graveside were Messrs. G. H. Rogers and W. H. Day, Directors of the Hemel Hempstead Gas Company; Mr. H. F. Benham, representing the Consulting Engineers to the Company (Messrs. Askew & Son); Mr. E. J. Skerman, the Secretary; Mr. D. Fortnum, Chief Clerk; Mr. E. H. Martin, Engineer to the Harpenden Gas Company; Mr. F. J. Robinson, Engineer to the Chesham Gas Company; Mr. G. W. Ellis, Engineer to the Berkhampsted Gas Company; the Gas Examiner to the Hertfordshire County Council; and Mr. Walter T. Dunn, a lifelong friend of the deceased. A number of the Company's workmen met the cortège about a quarter of a mile from the cemetery and led it to the gates.

It is with much regret that we have to announce the death, at his home on March 4, after a very brief illness, of Mr. HAROLD J. HAILSTONE, Chemist to the Rochdale Gas Department and President of the Manchester and District Junior Gas Association. In September, 1919, after 10 years with the firm of Messrs. Robinson Bros., West Bromwich, Mr. Hailstone was selected out of 30 applicants for the post of Gas-works Chemist and Manager of the tar and sulphate works under the Rochdale Corporation, a position rendered vacant by the resignation of Mr. T. Stenhouse. Mr. Hailstone took up his duties in October of the same year, and he had proved himself a most valuable official. He was a brilliant chemist, and had won many distinctions, including the medal and first-class honours certificate in Gas Engineering and similar honours certificates for coke manufacture, tar distillation, and gas supply. In 1923 he was awarded the first prize offered by the National Gas Exhibition for open competition throughout gas undertakings in the British Isles. Mr. Hailstone was an Associate Member of the Institution of Chemical Engineers and a Fellow of the Chemical Society; while last autumn he was elected President of the Manchester and District Junior Gas Association. He will be greatly missed at the gas-works, where his ability was highly appreciated, and throughout the wider sphere of chemistry in his district, for he seemed marked out for high distinction. Many articles of his appeared in the Technical Press. Mr. Hailstone leaves a widow and two daughters, to whom we tender our sincere sympathy. The funeral took place at the Rochdale Cemetery on Thursday, and was largely attended.

The death has occurred at the Gas-Works, Callington, of which he had been Manager for 27 years, of Mr. JAMES LAWRY, who was 63 years of age. Deceased had been a member of the Callington Urban District Council for several years.

The death has occurred, suddenly, at Hall Gowan, Carnforth, of Major ROBERT EWAN JACKSON, a Director of the Carnforth Gas Company, and a well-known North Lancashire land surveyor. He was a director of the Carnforth District Waterworks Company, and was formerly a member of the Carnforth Urban District Council.

ON THE ELECTRICAL SIDE.

Eighth Report of the Electricity Commissioners.

The eighth report of the Electricity Commissioners, issued three weeks ago, brings matters down to no later than March 31, 1928, and so is not of any great present-day interest. At the date named, there were, apart from the Central Board, 643 authorized undertakers in Great Britain, embracing 2 joint electricity authorities, 4 joint boards, 376 local authorities, and 261 companies. There were also five other statutory bodies not possessing supply powers, but having duties of an advisory or supervisory character. The unoccupied areas in which no supply of electricity had been authorized consisted mainly of the more sparsely populated rural portions of the country, amounting to 45 p.ct. of the total area, but containing only 5 p.ct. of the total population. The authorized distribution areas embraced over 92 p.ct. of the cities and boroughs, 86 p.ct. of the urban districts, and 58 p.ct. of the parishes in the rural districts in England and Wales; and about 68 p.ct. of the cities and burghs and 29 p.ct. of the civil parishes (exclusive of burghs) in Scotland. The authorized distribution areas in Great Britain covered about 89 p.ct. of the urban areas containing upwards of 97 p.ct. of the urban population, and nearly 42 p.ct. of the rural areas containing upwards of 67 p.ct. of the rural population.

There was an increase of about 19·6 p.ct. in the sale of electricity by authorized undertakers, and a total increase of some 88 p.ct. during the five years since 1922.

An Effect of the Frost.

The difficulty which abnormally cold weather is liable to impose upon electricity supply undertakings was exemplified recently by the case of a concern in a London suburb, who were compelled to request their consumers to use electric heaters as sparingly as possible between the hours of 4.30 and 8.30 p.m. The low temperature conditions had caused such an increase in demand that there was difficulty in dealing with it. The co-operation of the consumers was sought; but lest this plea should prove ineffectual, the significant remark was appended that the extended use of electricity for heating might result in a failure of the whole supply for lighting and other purposes. In such conditions as we have been enduring, such a request was perhaps a little hard on the consumers, who had possibly been comforting themselves with the reflection that there would be plenty of current available when they might require it. No doubt, the resources of the undertaking were sorely strained in dealing with an unprecedented demand, and the consumers came nobly to the rescue. Of course, no one would think of blaming the undertaking for finding itself in a condition to which the nature of the industry made it liable. A gas fire could, however, be enjoyed for the round of the clock, without any fear of putting a gas undertaking out of action. This seems to have a bearing upon the vital matter of "Service."

The Limit.

In a paragraph a few weeks ago, we reproduced the following from the "Dundalk Democrat," referring to a meeting of the Electricity Committee of the Urban District Council: "The Engineer submitted correspondence with the Great Northern Railway Company on the subject of electric lighting installations at the Company's local houses under the Assisted Wiring Scheme, and asking for consent to erect poles on the Company's property for the purpose of conveying current from the existing overhead mains to the houses. The Company had been notified that, notwithstanding consent to the erection of the poles being obtained, the proposal would not be carried out unless there was a fairly unanimous demand received from the tenants, and the latter would agree to the removal of the existing gas lighting fittings as and when electric light was connected. No definite reply on the matter had yet been received

from the Company. The Engineer added that he was arranging to have the tenants canvassed at an early date, and would report developments at the next meeting. There were 52 houses in all, and so far only fourteen applications under the Assisted Wiring Scheme had been received."

Now, the Dundalk Gas Company showed a very natural (and most laudable) indisposition to take this "lying down;" and Mr. George Airth (their Engineer, Manager, and Secretary) communicated with the Ministry of Industry and Commerce, urging that the refusal to supply electricity unless the tenants agreed to the removal of their gas lighting fittings, was an infringement of the "right of the householder to order his own household." The reply of the Ministry was to the effect that the Dundalk Urban District Council "did not appear to have obtained any authority to impose such conditions." The tenants will be glad no doubt that the Gas Company have been public spirited enough to frustrate this effort at interference with the freedom of the subject.

How Electricity Competes.

There is something strangely familiar to us on this side in the experience at Dundalk, as recounted by Mr. George Airth in his letter (above alluded to) to the Ministry of Industry and Commerce. He says: "The Urban District Council of Dundalk have, since the inauguration of the electricity works in 1913, debarred the Gas Company by minute from putting in gas to any of their artizans' dwellings for lighting purposes. Some years ago they gave permission to instal gas cookers when asked to do so, but still insisted that no gas could be used for lighting purposes. In that particular instance, I presume that, as owners of these artizans' dwellings, they were entitled to lay down conditions as to the method of lighting their own houses."

American Capital for British Undertakings.

There was mention in the "Journal" a few weeks ago of a speech by Mr. Frank H. Jones, M.Inst.C.E., at one of the luncheons in connection with the Joint Gas Conference at the recent British Industries Fair, Birmingham. In this Mr. Jones commented as a Britisher upon a wish expressed by a previous speaker that, if the gas industry of this country needed further capital, it would not go for it outside the realm of sterling. Mr. Jones, indeed, expressed himself as being entirely at one with this sentiment. The question has already presented itself in connection with the electrical industry; the Greater London and Counties' Trust having come under American control, owing, as explained by Mr. F. M. Rogers (Deputy Chairman of the Trust), "to the policy of the Trust in obtaining its money from the cheapest source." It seems that the Board is to remain completely British, as well as the employees and the machinery. We learn from the "Financial Times" that the Trust controls companies owning bulk electric lighting and power plants in Southern England. The subsidiaries which are stated to be concerned in the present deal are the Bedfordshire Cambridgeshire and Huntingdonshire Electricity Company, the Cookham and District Electric Corporation, the East Anglian Electric Supply Company, Edmundson's Electricity Corporation, the Oxford Electric Company, the Wessex Electricity Company, and the Western Electricity Supply Company.

It is announced that the Utilities Power and Light Corporation, of America, have acquired the entire ordinary share capital of the Trust. This represents an almost complete interest—even up to the extent of 98 p.ct. The American Company, therefore, possesses an indirect but definite control of the seven Companies mentioned.

Sir Philip Dawson, M.P. (a Director of the Trust, the Chairman of which is Lord Birkenhead), stated in an interview that "British labour and British brains will have the valuable assistance of American money in a wide scheme to improve electric lighting and other electric utilities in this country. We hope to build-up a huge efficient supply which will satisfy people and bring electric lighting where there is at present none. Our one aim is to supply electricity to all classes, in all parts of the country at cheap rates. I think £10,000,000 is a moderate estimate of the amount which will be needed to carry out our intentions."

GAS STOCK AND SHARE MARKET.

[For Stock and Share List, see later page.]

The Stock Markets were in a very depressed state last week, and it is difficult to find any redeeming feature. Anxiety continued with regard to the monetary position, and it was not alleviated by the publicity given to the loss of control of American money by the Federal Reserve system. Declining prices were the rule almost everywhere, and there were few bright spots. Gilt-edged stocks were no exception; and it was a relief when, in the Miscellaneous Market, the announcement of the H.M.V. and Marconi wireless merger resulted in some activity.

The continued interest in the Foreign undertakings saved the Gas Market and European shares. Imperial Continental stock and Montevideo stocks all improved; and it will be seen by the Table that the changes in the Home Companies stocks, other than *ex* dividend reductions, were in an upward direction. The rises were: Liverpool 7 p.ct. red. pref. 1, Maidstone 5 p.ct. cap. 3, and Newcastle cons. 4½ points.

The South Shields Company have distributed dividend at the rate of 8½ p.ct. per annum (the same) for the past half-year, and the stock, which is quoted at the local exchange at the *ex* div. price of 106½-107½, yielding nearly 8 p.ct., is very attractive. The Directors of the European Gas Company are recommending the payment of a dividend at the rate of 7s. per share, free of income-tax, for the past half-year, as against 6s. per share for the corresponding period of 1927.

The following transactions were recorded during the week:

Monday.—Bournemouth 6 p.ct. pref. 11⅛, Cardiff 7½ p.ct. deb. 102½, 103, Commercial 98½, Continental Union 122, 124, 125, 125½, 127, 128, European 18½, 18⅝, 18⅝, 18¾, 18⅞, 19, 19⅛, 19¼, 19½, Gas Light and Coke 19s. 1½d., 19s. 2¼d., 19s. 4½d., 19s. 6d., 3½ p.ct. 64⅝, 4 p.ct. pref. 78, 78½, 5 p.ct. deb. 101¼, Imperial Continental 393, 395, 396, 397, 398, 399, 400, 402, 403, 405, Liverpool 7 p.ct. pref. 102¾, Primitiva 32s. 10½d., 33s., 33s. 2¼d., 33s. 3d., 33s. 4½d., 33s. 6d., 33s. 7½d., 33s. 9d., 33s. 10½d., 34s., 4 p.ct. con. deb. 80½, 4 p.ct. deb. (1911) 80, South Metropolitan 106½, 106¾, 107, 107½ 6 p.ct. pref. 109½, Wandsworth, Wimbledon 5 p.ct. 117. Supplementary prices, Tottenham 5 p.ct. reg. red. mort. 99½.

Tuesday.—Alliance and Dublin 100½, Bournemouth 6 p.ct. pref. 11⅛, Commercial 98½, Continental Union 123, 124½, 125, 126, 127, 128, European 19⅛, 19½, £19 11s., 19⅝, 19¾, 19⅞, 20, £20 0s. 9d., 20⅛, 20⅛, 20⅛, 20⅜, 20⅝, 20¾, Gas Light and Coke 19s. 1½d., 19s. 4½d., 4 p.ct. pref. 77½, 77¾, 78½, 3 p.ct. deb. 58¼, 60, 60¼, 5 p.ct. deb. 101¼, Imperial Continental 385, 387, 387½, 389, 389½, 390, 392, 394, 395, 397, 398, Primitiva 33s. 9d., 34s., 34s. 4½d., 34s. 6d., 34s. 7½d., South Metropolitan 106½, 107½, 3 p.ct. deb. 60, 6½ p.ct. deb. 102½, South Suburban 5 p.ct. deb. 99, Tottenham 3½ p.ct. 102¾. Supplementary prices, Hong Kong and China 5 p.ct. deb. 84, Wakefield 5 p.ct. 71.

Wednesday.—Aldershot 4 p.ct. pref. 74½, 75½, Bournemouth "B" 12¾, 13, 6 p.ct. pref. 11⅜, Commercial 98½, 99½, 3 p.ct. deb. 59, Continental Union 126, 127¼, 128, 128½, 129, European 20 1/16, £20 1s. 6d., £20 2s., 20⅛, 20⅜, 20½, 20⅝, 20¾, 20⅞, 21, 21¼, 21 1/16, 21⅛, 21½, 21¾, 21⅞, 22, 22 1/16, 22¼, 22½, 22 1/16, 22⅝, 22¾, 22⅞, 23, Gas Light and Coke 19s., 19s. 1½d., 19s. 3d., 19s. 4½d., 19s. 6d., 3½ p.ct. max. 64⅝, 4 p.ct. pref. 77, 77½, 3 p.ct. deb. 59¾, 5 p.ct. deb. 101¼, Imperial Continental 385, 390, 391, 392, 395, 397, 400, Primitiva 33s. 9d., 33s. 10½d., 34s., 34s. 1½d., 34s. 3d., 34s. 6d., South Metropolitan 106½, 106¾, 107½, Wandsworth new 103. Supplementary prices, Hong Kong and China 5 p.ct. deb. 84¼, Swansea 80¼.

Thursday.—Bombay 21s., Continental Union 125, 126, 126⅜, Croydon sliding-scale 110, European 22 1/16, 22½, 22 1/16, 22⅜, 23, 23⅛, 23¼, 23 1/16, 23⅜, 23½, 23 9/16, 23⅝, 23¾, 23⅞, 24, 24⅛, 24¼, 24½, 24⅝, 25, Gas Light and Coke 19s., 19s. 1½d., 19s. 3d., 19s. 4½d., 4 p.ct. pref. 77, 3 p.ct. deb. 60, 5 p.ct. deb. 101¼, Hastings and St. Leonards 5 p.ct. 97½, Imperial Continental 395, 396, 397, 398, 400, 401½, 402, 403, Newcastle 3½ p.ct. 17s. 1½d., Primitiva 33s. 6d., 33s. 10½d., 33s. 11¼d., 34s., 34s. 3d., 34s. 4½d., 4 p.ct. deb. (1911) 79⅜, South Metropolitan 107½.

Friday.—Barnet 7 p.ct. max. 113⅛, Bombay 21s., 22s., Bournemouth 6 p.ct. pref. 11⅛, Continental Union 125, Croydon sliding-scale 111, European 21¾, 22, 22⅛, 22¼, 22½, 22⅝, 22¾, 23, 23⅜, 23½, 24⅝, Gas Light and Coke 19s., 19s. 3d., 19s. 4½d., 4 p.ct. pref. 78, Imperial Continental 397, 398, 398½, 399, 400, 402, Newcastle 3½ p.ct. 17s. 3d., Primitiva 33s. 6d., 33s. 6¾d., 33s. 7½d., 33s. 9d., 34s., 34s. 3d., South Metropolitan 106⅝, Swansea 7 p.ct. pref. 101½, Tuscan 35s. Supplementary prices, Cheltenham 5 p.ct. max. 70½, Montevideo 6 p.ct. deb. 100.

Silver was a quiet market, the cash price being slightly lower at 26d. per oz.; while gold remained at 84s. 11½d. per oz. The Bank Rate is 5½ p.ct., to which it was raised from 4½ p.ct. on Feb. 7. The Banks' deposit rate is 3½ p.ct., and the deposit rates of the Discount Houses are 3½ p.ct. at call and 3¾ p.ct. at notice.

COMPLETE GASIFICATION.

Humphreys and Glasgow Combination Plant.

Recently we inspected, at the works of the North Middlesex Gas Company, a highly interesting new plant for the complete gasification of coal. It is a product of a firm whose reputation stands high in gas engineering circles throughout the world—Humphreys & Glasgow, Ltd.—and it is a product, too, every detail of which has been subjected to very careful analysis. Actually the plant has worked for 300 days on coal alone, and 150 days on coke, and it has been possible to examine every phase of its operation. That the latter has proved eminently successful is well demonstrated by the fact that Mr. L. Trewby, the Engineer and Manager of the Company, has decided to instal a further unit. He explained to us that the plant fully met all the claims of its makers during the recent prolonged spell of severely cold weather which resulted in the 1928-29 winter being the coldest on record since 1894-95. Our readers are well aware of the strain which this imposed on all types of gas-making plant, to say nothing of the anxiety of those responsible for its operation; and Mr. Trewby confessed quite frankly that the position in regard to his district would have been very different had there been the slightest hitch in the working of his complete gasification plant. However, throughout the whole of this trying time the plant worked smoothly and efficiently.

Flexibility is undoubtedly the chief characteristic of the Humphreys & Glasgow plant. It is designed for the gasification of coal or coke, or any mixture of coal and coke, and for the subsequent enrichment of the gas with oil, as desired, with the same convenience and efficiency as in the firm's standard carburetted water gas plant. In brief, the operation of the unit—which is here shown diagrammatically—is as follows.

SUMMARY OF METHOD OF WORKING.

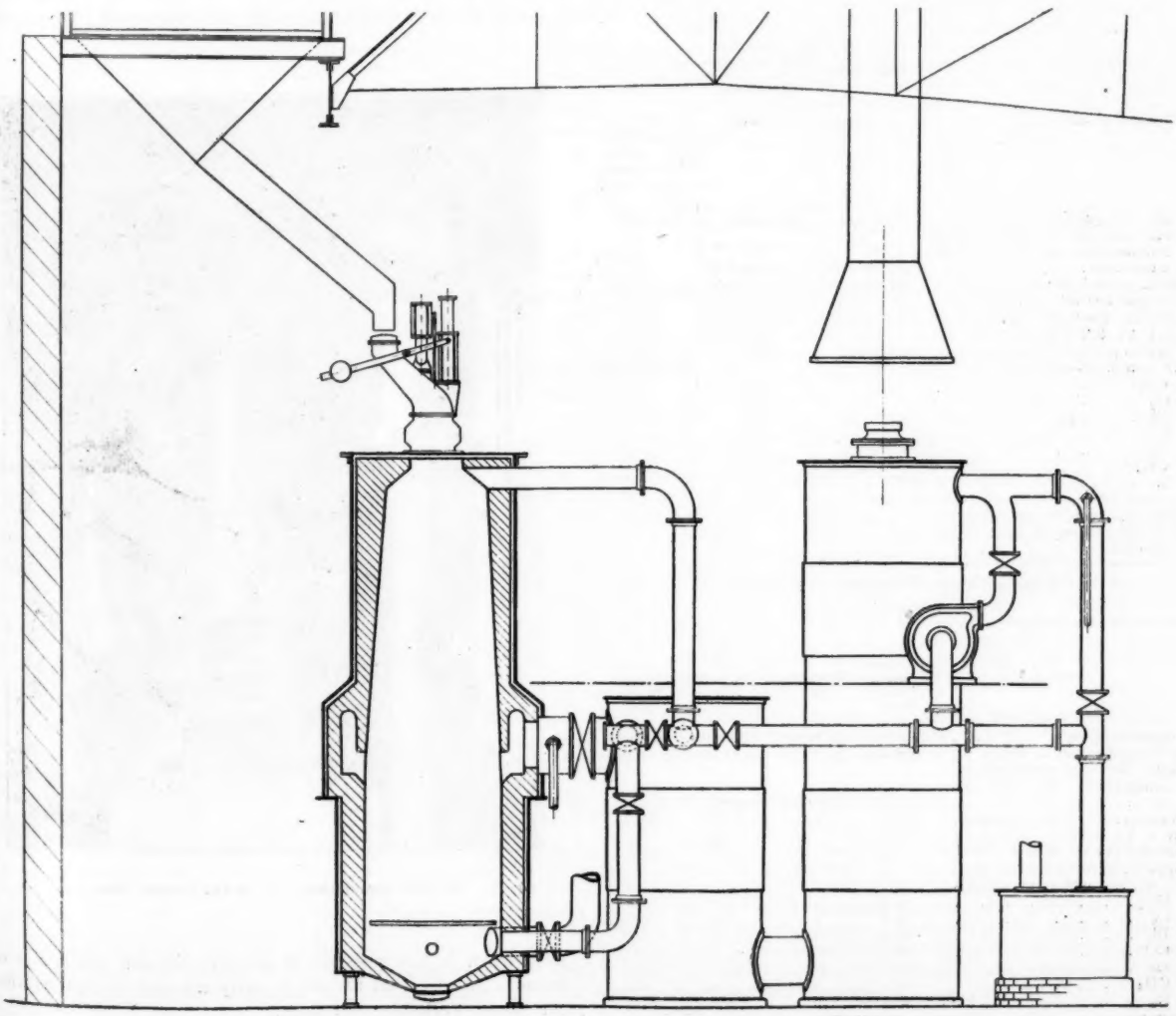
The blow takes place through the lower part of the generator, or water gas production zone, and the products are led off, by way of the annulus, through the hot gas valve into the carburettor top. In the carburettor and superheater the sensible and latent heat of these products is stored and subsequently utilized partly to assist in the carbonization of the coal by transference back to the generator, and partly for carburetting the gas produced, if so desired. Coal gas is bled off from the upper part of the generator or carbonizing chamber during the blow, and passes to the washer through a separate seal.

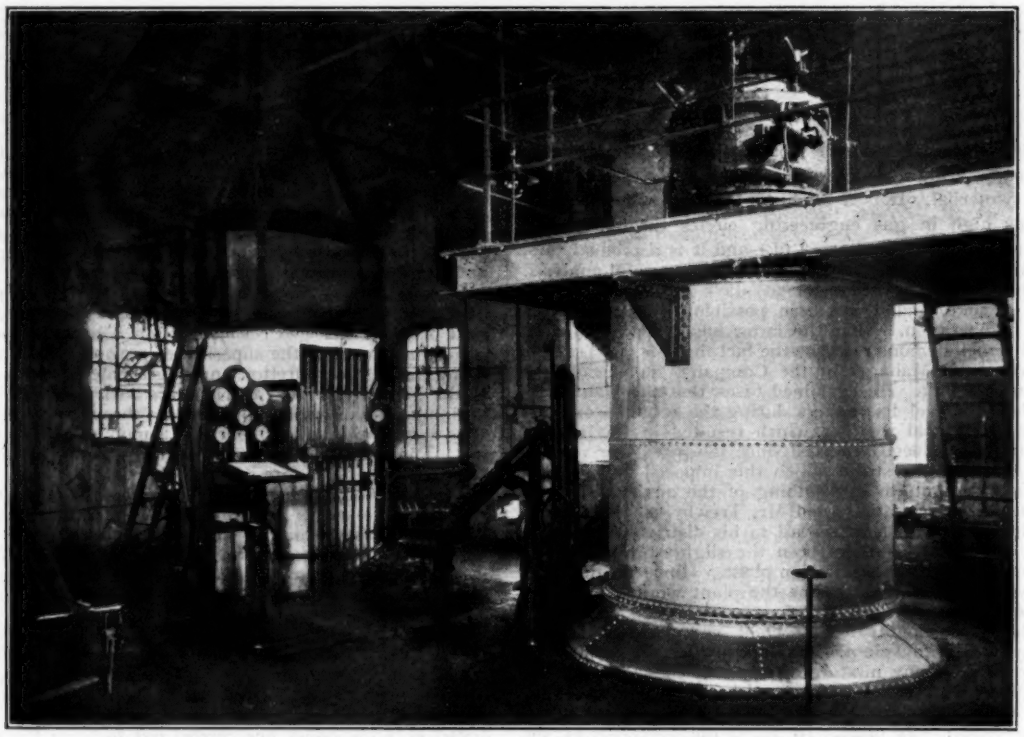
During part of the run the coal in the upper part of the generator, or carbonizing chamber, is carbonized by the sensible heat of the water gas resulting from a back-run produced by admitting steam to the superheater top, superheating it in the fixing vessels (carburettor and superheater), and admitting it to the generator base. During this back steaming period gas is circulated with the back-run steam through the fixing vessels, thus augmenting as necessary the supply of heat to the generator. The gas circulated is taken from the supply issuing from the generator top before it enters the washer.

During another part of the run, steam not superheated in the fixing vessels is admitted to the generator base, and the hot water gas produced is also passed through the coal in the upper part of the generator. The mixed gas in this case, instead of passing from the generator top direct to the washer, is led into the carburettor, when it can be carburetted as desired.

According to the conditions of working and the character of the fuel, down-runs can be made by admitting steam to the blast annulus and passing this steam downwards through the lower part of the generator. The water gas produced can also be carburetted if desired by admitting it to the carburettor.

Dr. H. C. Colman has carried out tests on the plant when working on coal alone. These tests were respectively of 72 hours and 12 hours duration. During the greater part of the longer test it was impossible to obtain fresh coal from known sources, and weathered stock coal from the yard had to be used. Consequently the results were inferior to those obtained when good fresh South Yorkshire coals were employed.





VIEW FROM THE OPERATING FLOOR (the top part of the generator in the foreground).

Summary of Results of Tests carried out by Dr. H. G. Colman on the Humphreys-Glasgow Complete Gasification Plant at the Works of the North Middlesex Gas Company.

UNCARBURETTED GAS.

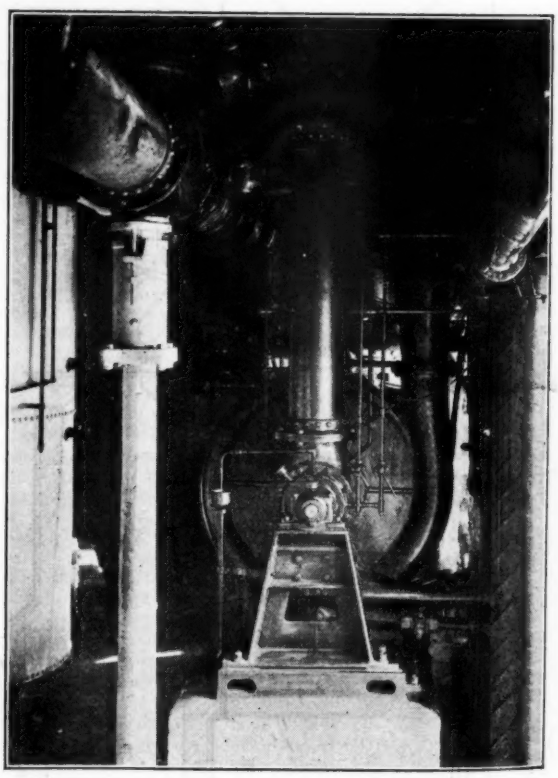
—	1. Manvers Main Nuts.	2. S. Yorks Nuts from Stock with 9 Tons of Thorncliffe Nuts.	2. Fresh Thorncliffe Nuts.
Duration of test	12 hours	72 hours	Period during 72 hours test when Thorncliffe nuts were used.
Total coal gasified	6·38 tons	39·60 tons	9·0 tons
Total gas made, corrected for temperature, pressure, and air admission	351,850 c.ft.	2,043,850 c.ft.	..
Make per ton of coal gasified	55,150 c.ft.	51,610 c.ft.	52,630 c.ft.
Coal gasified per 24 hours	12·76 tons	13·20 tons	..
Total gas made per 24 hours	703,700 c.ft.	681,280 c.ft.	..
Av. C.V., B.Th.U. per c.ft.	345	334	342
Therms per ton of coal	190·2	172·1	180
Av. composition of gas—			approx. com.
CO_2	..	5·2	4·8
O_2	..	0·3	0·2
Ill.	..	0·5	0·6
CO	..	31·8	32·1
H_2	..	49·2	49·2
CH_4	..	5·0	5·2
N_2	..	8·0	7·6
B.Th.U. of coal in gas produced	..	54·5	57·0
P.ct. of carbon of coal in gas produced	..	41·2	43·0

Tests Made by Humphreys & Glasgow.

UNCARBURETTED GAS.

—	1. Hoyland Silkstone Washed Nuts.	2. Thorncliffe Nuts.	3. Thorncliffe Nuts.	4. John Brown Washed Nuts.
Duration of test	24 hours	24 hours	24 hours	24 hours
Coal gasified per 24 hours	12·38 tons	14·1 tons	14·22 tons	12·96 tons
Make per day, corrected for temperature, pressure, and air	640,000	755,600	767,630	731,780
Make per ton of coal gasified	51,700	53,580	53,980	56,460
Av. C.V., B.Th.U. per c.ft.	347	349	333	327
Therms per ton of coal	179·4	187	179·7	184·6
Approx. composition of gas; air to purifiers included—				
CO_2	6·7	5·9	5·3	6·1
O_2	0·8	1·2	1·0	0·95
Ill.	0·9	0·8	0·55	0·6
CO	28·3	28·8	29·65	26·35
H_2	48·6	47·5	47·8	48·0
CH_4	6·1	5·8	5·9	6·9
N_2	8·6	10·0	9·8	11·1

All coals used on these tests were South Yorkshire nuts; but from time to time Durham coals, mostly fines, have been used. It was, however, impossible to isolate the plant for test purposes while on Durham coal; and all that can be said to date is that these more difficult coals were apparently handled successfully so far as their gasification was concerned. On several days when it was possible to measure the gas made, it was found, however, that the set capacity was not so high as with the South Yorkshire nut coals.



The Gas Circulating Unit on the Ground Floor.

On the 72-hour test made by Dr. Colman, all coal was sampled and analyzed. The results were as follows:

Average Sample of all Coal Used.

PROXIMATE ANALYSIS ON AIR-DRIED SAMPLE.

	P.Ct.		P.Ct.
H_2O	1·7	Fixed carbon	60·5
Volatile matter	33·3	Ash	4·5

ULTIMATE ANALYSIS ON AIR-DRIED SAMPLE.

	P.Ct.		P.Ct.
H_2O	1·7	S_2	2.1
C	78·8	O_2	6·3
H_2	5·0	Ash	4·5
N_2	1·6	B.Th.U. per lb.	14,100

For the fresh Thorncliffe nuts used during part of the 72-hour test, the results were as follows:

PROXIMATE ANALYSIS ON AIR-DRIED SAMPLE.

	P.Ct.		P.Ct.
H_2O	1·9	Fixed carbon	59·0
Volatile matter	34·3	Ash	4·8

ULTIMATE ANALYSIS ON AIR-DRIED SAMPLE.

	P.Ct.		P.Ct.
H_2O	1·9	S_4	1·9
C	78·3	O_2	6·4
H_2	5·1	Ash	4·8
N_2	1·6	B.Th.U. per lb.	14,100

In determining the relative advantages, in any particular instance, of installing complete gasification plant, there may perhaps be a tendency to compare this combination unit simply with carburetted water gas plant. This, however, leaves out of account the savings resulting from the production of coal gas in the combination plant, as well as the elimination of coke handling. It is more logical to compare the combination plant with separate coal gas and carburetted water gas units in the proportion of (say) 20 to 25 p.ct. coal-gas plant, and 80 to 75 p.ct. carburetted water gas plant, depending upon the amount of carburetting desired. Such comparison will include, in the cost of the coal gas plant *per se*, buildings and ground, charging and drawing machinery, coke handling plant, &c., none of which is required in the case of the 20 to 25 p.ct. of coal gas made in the complete gasification plant. There is also the saving of costs of quenching, handling, elevating, storing, and charging the coke, and of loss through the production of breeze; and there is the saving in labour over the two separate plants. Besides, the repair costs on the coal gas portion of the combination plant will be smaller than on a separate coal gas plant including accessories.

As regards gas-making efficiency, the North Middlesex results indicate that with South Yorkshire nuts or equivalent one may count upon about 180 therms in the gas produced per ton of coal by the Humphreys & Glasgow plant. At North Middlesex, the make of water gas (apart from the coal gas) per ton of coal was what should be obtained in standard water gas plant from over 13 cwt. of coke, whereas 10 cwt. of screened coke per ton of coal carbonized in separate coal gas plant is more than can be delivered into separate water gas generators.

NEW OFFICES FOR THE GAS LIGHT AND COKE COMPANY.

Imposing Premises at Kensal Green.

The ever-increasing demands of the district have convinced the Gas Light and Coke Company of the necessity of more adequate accommodation for their office staff at the Kensal Green Works; and accordingly the most up-to-date and spacious premises have been erected on a site just inside the entrance to the gas-works, to provide for the Station Engineer and his Assistants, the coke orders staff, and an up-to-date laboratory.

The offices were formally opened on March 7 by His Worship the Mayor of Kensington (Alderman Henry Robinson, M.A., M.D., J.P.), when a large gathering of visitors were entertained to tea by the kind invitation of the Governor and Directors of the Gas Light and Coke Company. Sir DAVID MILNE-WATSON, Governor of the Company, presided, and among those present, besides His Worship the Mayor, were the General Manager of the Company (Mr. R. W. Foot), the Secretary (Mr. W. L. Galbraith), the Station Engineer (Mr. A. A. N. Carpenter), and members of the Borough Council.

After tea, Sir DAVID MILNE-WATSON said he had much pleasure in asking His Worship the Mayor of Kensington to declare the new offices formally open. In the course of a few remarks Sir David said that the Company were pursuing their policy of reconstruction wherever needed, as was indicated in this neighbourhood by the opening recently of the new showrooms in Church Street, Kensington. They would now be pleased to see that the Company were opening these modern offices and laboratory at Kensal Green. The staff would be able to work under much more favourable conditions than heretofore, while the laboratory was one of the most up-to-date of its kind in existence. Their first duty was, of course, to sell gas, but after that they must be in a position to render accurate accounts. They sold a very great deal of coke in addition, and it was with this side that the office would be chiefly concerned. Sir David Milne-Watson went on to mention their new smokeless fuel—"Gloco"—and said that at the moment the demand far exceeded the supply. The particular advantage of this fuel, which they were manufacturing at the new plant at Richmond, was that it could be burnt with excellent results in the ordinary coal grate. The old type of coke, however, was very good for domestic purposes if people would only take the trouble to make their grates suitable. In conclusion, he said that the Company had a very long-standing association with the Borough of Kensington, and he was pleased to see their representatives.

His WORSHIP THE MAYOR OF KENSINGTON heartily endorsed the Chairman's remarks on the associations between the Borough and the Company. He had on a previous occasion been present at the inauguration of some new plant at the Fulham Works, and was very interested in the progress of the Company. He paid high tribute to the Company's co-partnership scheme, which, he said, did so much towards the better co-operation between officials and workmen, which naturally resulted in more satisfactory service to the customers. He had much pleasure, therefore, in declaring the premises open.

Sir DAVID MILNE-WATSON proposed a vote of thanks to the Mayor for coming to open the offices, and went on to say that the Borough and the Company were definitely associated with one another in three particular ways—in the first place, that the Company supplied gas to the Borough; secondly, that they paid rates to the Borough; and thirdly, that, by supplying gas, they were relieving the roads of a great deal of unpleasant traffic in the shape of coal carts, which would otherwise be there, and at the same time helping to purify the air. In conclusion, he said that the building reflected the greatest credit on the architect, Mr. Walter Tapper, A.R.A., Pres.R.I.B.A.

Councillor HUDSON then proposed a hearty vote of thanks to the Gas Light and Coke Company for their hospitality.

As stated, the new building occupies a position close to the entrance to the Kensal Green Works, and is an imposing two-storey edifice in red brick. Besides the smaller offices, there are three main rooms. That on the ground floor is occupied by the coke order staff, while immediately above it is the laboratory. This is a very fine room, fully equipped with all the apparatus for the testing and sampling of the various products, and includes a Fletcher furnace for volatility and ash determination at 1000° C., and a Pensky Marten flash point apparatus. Adjoining the laboratory is the Chief Chemist's office. On the top floor is a spacious room for recreation or receptions. It has windows on three sides. The numerous smaller rooms are for the Works Engineer, his assistants, and other officials. The lighting and heating is by gas throughout, the former being switch controlled, and the latter consisting of fires and radiators.

By the erection of these fine offices the Company have brought this Station well into line with the other up-to-date premises throughout their area of supply.

It is of interest to note that a new waterless gasholder is in course of construction at these works. It will have an approximate capacity of 4½ million c.ft., with storage room beneath.

"Chemical Engineering and Chemical Catalogue."—The fifth edition of this useful volume has been published at 15s. by Leonard Hill, Ltd., 231-232, Strand, W.C. 2. The editor is Dr. D. M. Newitt; and this edition embraces several improvements on previous publications, including a more attractive binding, commensurate with the greater co-operation and wider distribution. The division of the various sections is now shown by thumb indentations instead of protruding tabs. The Data and Tables section has been doubled, many of the tables being especially compiled for the Catalogue and published for the first time. The Technical Books section has been revised, and selected books produced during the year have been included. There is an interesting foreword by Sir Robert Hadfield, Bart., D.Sc., on the subject of high-pressure plant and equipment, with tables of tensile strength and comparative resistance of various types of steel.

WELFARE WORK AT BECKTON.

Opening of the New Ambulance Building.

At each works of the Gas Light and Coke Company, a Committee elected by all grades provides an opportunity for regular discussion, under the chairmanship of the Engineer, of matters relating to the well-being of the Company and the men. Suggestions for the prevention of accidents, the improvements of plant, and so forth, are also encouraged. These are considered by a special representative Committee, upon whose recommendations the Directors grant suitable awards. Training in first aid is undertaken throughout the Company, and the Works Committees take great interest in this and in all matters connected with the prevention of accidents. In connection with this branch of the Company's activities, a new ambulance building has been provided at Beckton, and equipped with all the latest devices which science can suggest for the prompt and efficient treatment of cases of accident; and this was formally opened on Tuesday of last week by the Rt. Hon. Sir John Anderson, P.C., G.C.B., Permanent Under-Secretary of State, Home Office.

SIR JOHN ANDERSON, PERMANENT UNDER-SECRETARY, HOME OFFICE, WITH SIR DAVID MILNE-WATSON IN THE AMBULANCE ROOM.

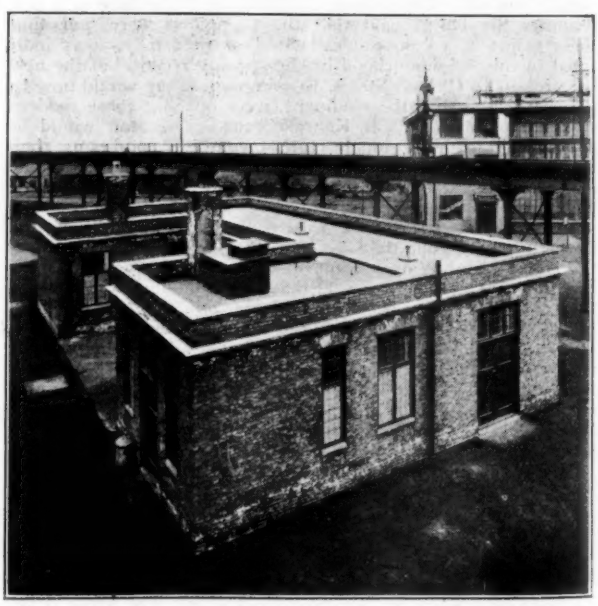
The ceremony of unlocking the door and inspecting the new building (under the guidance of Dr. D. A. Coles) was preceded by a luncheon, under the Chairmanship of Sir David Milne-Watson, LL.D., D.L., the Governor of the Company, who took occasion to refer to the abnormal circumstances by which gas undertakings have been faced during the recent spell of arctic weather.

Record Demand for Gas.

The Governor stated that the Beckton Works and the whole of the Company's district had lately been extremely busy. The public had helped themselves to the supply "of heat on tap" to an unprecedented extent; and he hoped they would remember to how great an extent, when they got their bills for the present quarter. The consumers—and mainly, of course, the domestic consumers, for the industrial demands were not influenced to like extent—had caused the Company to break very decidedly every record in their history, so they must not be surprised when they received proportionately heavy bills. He hoped the consumers would remember, when that time arrived, all the comfort they had enjoyed from their fires and their hot meals and baths during the very cold weather.

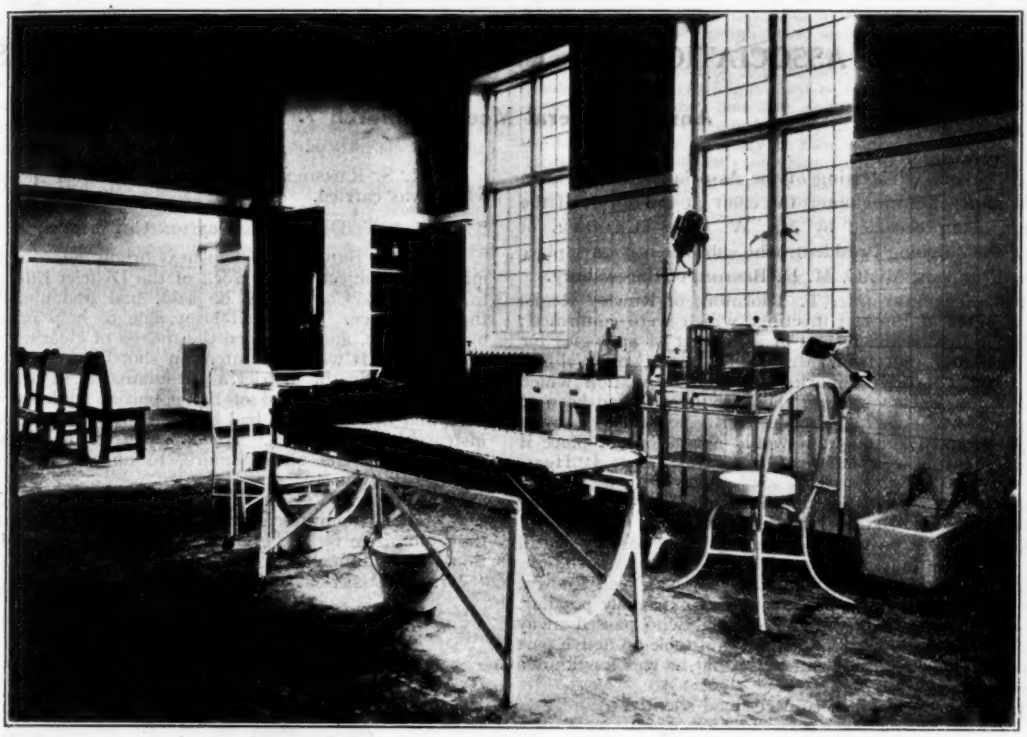
A few figures would make clear the demand which the works and mains had had to meet; and he might tell them that the Company were not a little proud that they had been able to meet this demand without any kind of breakdown or shortage, except in a few isolated instances where appliances had been installed without the Company's knowledge, or against their advice, on pipes already sufficiently loaded. There had, of course, also been some instances in which consumers were deprived temporarily of gas by the action of frost on moisture condensed in their service pipes. These troubles, much regretted, but due to causes beyond the Company's control, were remedied as soon as possible. Speaking broadly, they had been able to maintain a full supply of normal quality gas at normal pressures all through this period of very abnormal demand. How abnormal the demand was, the following facts would illustrate.

The heaviest month's output previously recorded was that for December, 1927, when the Company sent out 5778 million c.ft., an average of 186 million c.ft. per day. In January last, they sent out 6046 millions, and in the short and much lighter month of February 5708 millions, or 204 millions per day.



The Ambulance Station viewed from the Viaduct.

In the seven days ended Feb. 18, the output was 1587 million c.ft.—against a previous best of 1445 millions in Christmas shopping week, 1927, and against only 1120 millions in the



THE DRESSING ROOM.

same week of February last year. The increase in those seven days of 467 million c.ft. considerably exceeded the total output for the same period in the whole city of Birmingham, and would supply many considerable towns for a year. On Friday, Feb. 15, London "helped herself" to no less than 240,543,000 c.ft. from the Company's mains; whereas until this year the record day's output had been 225,873,000 c.ft. on one of the shortest days in the year—to be exact, on Dec. 20, 1927.

So that the Company had had the highest day's output, the highest week's output, and the highest month's output, during the spell of abnormal frost—a good testimony alike to the popularity of gas as a fuel and to the provision made by the Company for coping with the demand arising from it.

LOOKING AFTER THE WORKERS.

Coming to the new ambulance building, the Governor said that this had been carried out to the plans of a distinguished Architect, Mr. Walter Tapper, A.R.A., Pres.R.I.B.A., who had, it must be admitted, produced a very fine ambulance station. The Company were doing all they possibly could in this way, because they felt it was the least they owed to the men who worked for them. It must be remembered that gas making was not really a dangerous operation; but in spite of all regulations, accidents would happen sometimes. The works had possessed their own ambulance room for many years past, but the one which was to be opened that day was the last word in such matters. In order to encourage the men in paying attention to this important subject, a challenge shield had been provided; and this shield had been won by Beckton for the past year's work. The present admirable position had been attained largely through the energy of their friend, Dr. Coles, who was in charge of this station, and to whom the Company owed a great debt of gratitude. It had been to him a labour of love. Much credit was also due to the members of the first-aid contingent.

Sir JOHN ANDERSON said it was a great pleasure to him to come, as a representative of the Home Office, to open this new ambulance room. The Home Office was very directly concerned with the regulation of industrial conditions; and among the new developments in factory legislation probably the most important was that which was described by the somewhat vague words "Welfare Work." The most characteristic, and perhaps the most important, feature of welfare work was to be found in the ambulance room or first-aid room, which most up-to-date establishments now possessed. Welfare work could perform the function of bringing together the employer and employee, because if the best results were to be derived from the welfare organization of any industrial establishment there must be practical co-operation between the two sections. From the point of view of the Home Office, such a development as was being inaugurated by the Company that day was of very great importance.

The MAYOR OF EAST HAM, who also spoke, said that thirty or forty years ago he was employed by the Company, and he would like to pay his tribute to the important part which those engaged in the Company played, outside of their work, in the welfare and social activities of the local community.

VOTE OF THANKS.

After the ceremony of opening the new ambulance room, a vote of thanks to the Governor was proposed by Mr. R. R. HYDE, Director of the Welfare Society, and carried with acclamation.

Inquest on Chandelier Tragedy at Sheffield.—Mention was made in our last issue (p. 679) of the three tragedies caused by faulty gas chandeliers at Liverpool, Bath, and Sheffield respectively. The inquest was held on March 6 at Sheffield on Mr. R. Holderness and his wife; and evidence showed that death was due to the water having evaporated from the old-fashioned sliding chandelier, thus allowing the gas to escape. A verdict of "Accidental death" was returned in accordance with the evidence; and Mr. A. Wiley (Superintendent of the Fittings and Sales Department of the Sheffield Gas Company) stated that this type of gas fitting had been obsolete for thirty years. It was unsafe, and the Company advised people to replace them.

New Lamplighting System for Bradford.—The Bradford Corporation Gas Department recommends the City Council to approve a torch system of lighting the street gas lamps instead of the present system of lamplighters walking from lamp to lamp with a ladder and box of matches. The Department's argument was that the personal attendance of a lamplighter to every lamp twice daily (lighting and extinguishing) guaranteed a more regular maintenance service than was possible under the automatic control system. The cost of matches was about £337 per annum, whereas the estimate for matches and carbide for the torches was £180 per annum, effecting a saving of £157. The purchase of the torches would cost about £180. The average work of Bradford lamplighters is 88 lamps per man.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

Annual General Meeting, March 7.

The Annual General Meeting of the Association was held in the Grand Hotel, Birmingham; the chair at the outset of the proceedings being occupied by Mr. W. G. S. CRANMER, of Willenhall, the outgoing President, who subsequently gave place to the new President, Mr. C. M. D. BELTON, of Shrewsbury.

The HON. SECRETARY (Mr. T. Thornton, of Rowley Regis) read the minutes of the last meeting, which were confirmed; and he also intimated the receipt of a number of apologies for absence, including one from Mr. J. T. Lewis, of Wellingborough. Mr. Thornton remarked that an intimation which appeared in that week's issue of the "JOURNAL" had been to the effect that Mr. Lewis had completed fifty years' service with the Company, and he thought it would not be out of place if the meeting sent him a letter of congratulation. ["Hear, hear."]

Mr. CRANMER proposed that this be done; and after having been seconded by Mr. BELTON, it was agreed to.

Mr. CRANMER went on to express regret at the loss by death, since the last meeting, of two members of the Association. Mr. Charles Dakin, who died on Oct. 29, was well known, particularly to the older members, and was extremely popular. Mr. P. G. Winstanley, of Wolverhampton, who passed away in February, was an unassuming man, and took no active part in the proceedings of the Association, so that he was less known to the members generally.

Those present as a mark of respect stood silently.

INSTITUTION BENEVOLENT FUND.

Mr. CRANMER (proceeding) said he was glad to welcome that afternoon Mr. W. B. McLusky, of Halifax, the President of the Manchester District Institution, and Mr. J. W. Campbell, the new Secretary of the Institution of Gas Engineers. Mr. Campbell was following Mr. Dunn, who had been compelled to retire from considerations of health. He felt sure they could promise Mr. Campbell the hearty support of all members of the Midland Association, and of the Institution. Every member of the Midland Association who was eligible should be a member of the Institution of Gas Engineers. While referring to this matter, he would like to mention the question of the Benevolent Fund of the Institution. The Midland Association had, in the past, done what they could in support of this Fund, largely through the efforts of the late Mr. Charles Meiklejohn, of Rugby, and the late Mr. Thomas Berridge, of Leamington; but of later years there had been considerable losses by death and removal, and an influx of younger members. It was to those of the new members who were not already supporting the Benevolent Fund that he wished to make an earnest appeal to do so.

The annual report and statement of accounts were then approved.

MIDLAND COMMERCIAL GAS ASSOCIATION.

Mr. P. N. LANGFORD (Coventry) proposed the adoption of the report for the past year of the Commercial Association. He said it was the fifteenth year of the Section's activities, and during the past twelve months the membership had increased by 2 to a total of 68. He would like to appeal to those who were not already connected with the Commercial Section to join up, because it undoubtedly did a great deal of good work. It was most useful for the administrators of both the large and small gas undertakings to get together and discuss problems which appertained to that side of the industry. The attendances at the meetings were not always what might be desired, and the Committee hoped for an improvement in this respect. Questions dealt with included coke and coal—particularly coke, which had caused them special anxiety during the earlier part of the period. With the recent cold weather, of course, coke stocks had disappeared, and the trouble had become more one of finding fresh supplies. In the Midlands, they had a co-operative tar scheme, which functioned satisfactorily. This idea had been taken up in various other parts of the country, and he thought ultimately the result would be closer working between the different groups, which in the end must be to the good of the industry generally. In connection with tar, he would like to pay tribute to the British Road Tar Association, who were now beginning to get down to really good work in relation to the use of British tar on British roads. The Association possessed a strong Technical Committee, which was dealing with the subject of approved specifications to meet the wishes of the Road Surveyors. There was also a Propaganda Committee, who were doing good work. The accounts of the Commercial Section were satisfactory. They had a balance in hand of well over £100.

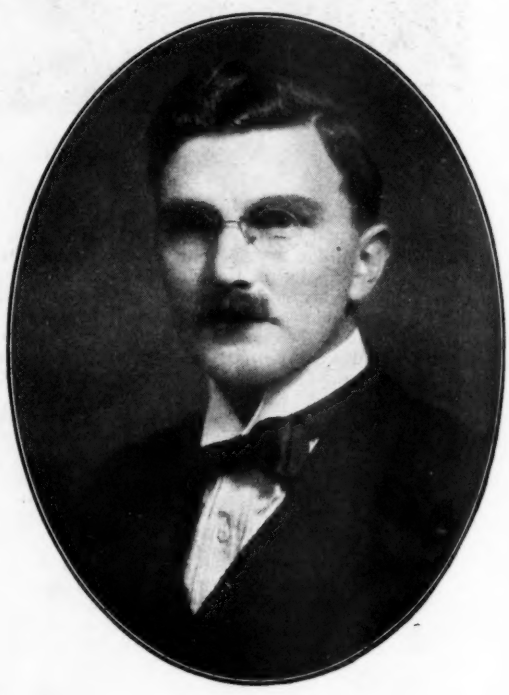
Mr. R. S. RAMSDEN (Leamington) seconded the proposition, which was carried.

DISTRICT EDUCATION COMMITTEE.

Mr. F. C. BRIGGS (Dudley) next briefly addressed the meeting on the subject of the work of the District Education Committee. This Committee, he said, had undoubtedly justified their existence. They had been able to help many students over the stile, and had been the means of clearing up a lot of difficulties. It was their intention shortly to issue to each gas undertaking in the district a questionnaire, in order that they might become informed of the potential students in the district, and whether there had been any difficulty in providing the instruction they needed. He appealed to all engineers, when they received the questionnaire, to answer it in the fullest manner possible.

Mr. WILLIAM WILSON (Burton-on-Trent) seconded the adoption of the Committee's report, and thanked Mr. Briggs and the Committee for the great help they had rendered in connection with a difficult case which had arisen at Burton.

Mr. MCLUSKY agreed that the Committee were on right lines in what they were doing; and the report was then unanimously agreed to.



THE PRESIDENT,

C. M. D. Belton, of Shrewsbury.

ELECTIONS.

Mr. BELTON was appointed the representative of the Association on the Council of the Institution of Gas Engineers for the twelve months following the annual meeting next June.

Mr. CRANMER, referring to the question of the re-election of the members to represent the Association on the Midland District Education Committee, said he did not think there was any minute to the effect that this Committee should be re-elected annually, but it had been felt by the Committee of the Association that this should be done. Mr. Briggs, who had done exceedingly good work, was Chairman of the Committee. The proposition was that Messrs. C. M. D. Belton, Alfred Bird, W. G. S. Cranmer, and Fras. C. Briggs be re-elected to represent the Association. There were four other members of the Committee elected by the Junior Association.

Mr. LANGFORD, in proposing these names, remarked that continuity of service, particularly at the present juncture, was highly desirable in connection with such a Committee.

Mr. HAROLD DAVIES (Chesterfield) seconded the motion, which was agreed to.

Mr. CRANMER said that at the last meeting of the Committee it was suggested that Mr. J. N. McColl (Halesowen) and Mr.

H. J. Dean (Ludlow) be elected honorary members of the Association. Both had long been connected with the Midland Association, and both were now out of harness.

The proposition was cordially agreed to.

THE NEW PRESIDENT.

Mr. CRANMER remarked that the time had now arrived for him to hand over the reins of office to his successor, who he trusted might have as pleasant a year as he (the speaker) had enjoyed.

Mr. C. M. D. BELTON (Shrewsbury) then took the chair, and proposed a vote of thanks to Mr. Cranmer for his work during the past year. Mr. Cranmer, he said, had served the Association for a good many years as Secretary, and had also done much work in the educational branch, and now he had added to their indebtedness by his excellent year's work in the chair of the Association.

Mr. BRIGGS seconded the vote, which was carried by acclamation, and replied to by Mr. CRANMER, who was presented with a medallion, as a souvenir of his Presidency.

PRESIDENT'S ADDRESS.

Mr. BELTON then delivered his address, which is reproduced in another part of this issue.

Mr. CRANMER, at its conclusion, proposed a hearty vote of thanks to Mr. Belton for his excellent Presidential Address.

Mr. W. S. MORLAND (Gloucester) seconded, and said the address had impressed him because it showed that Mr. Belton was keeping his works admirably up-to-date.

Mr. H. J. WOODFINE (Wellington) desired to support the vote, as one who had known Mr. Belton for a long time, and had always recognized him as a very able and progressive engineer. He had converted his Company into an extremely prosperous concern.

The PRESIDENT suitably acknowledged the vote.

SPRING MEETING.

The PRESIDENT said he was looking forward with great pleasure to the opportunity of welcoming every member of the Association at Shrewsbury on Thursday, May 16. He had to apologize for the absence of his Chairman, who was kept away by an important engagement. Mr. Robert Williams, another Director, had, however, come to extend the invitation.

Mr. ROBERT WILLIAMS said that, had the Chairman been present, he would have told the members how highly the Board appreciated the honour the Association had conferred upon them by electing their esteemed Engineer as President. The Directors would be delighted to see the members at Shrewsbury on the date mentioned, and to entertain them at luncheon. The Board and Mr. Belton would make every effort to ensure an enjoyable and profitable visit.

ARE OUR MANUFACTURING METHODS PROGRESSING?

The remainder of the meeting was devoted to a lengthy discussion on the manufacturing methods of to-day.

Mr. WILLIAM WILSON (Burton-on-Trent), in opening the discussion, remarked that the progress being made at the present time was slow; but they were all up against electric competition, as well as low-temperature carbonization, and he was wondering exactly where they were, and where they were heading to. He did feel that they were not progressing as rapidly as they might. Capital expenditure, interest charges, ever-increasing rates and taxes, all had to be faced; and they could not hope for much (if any) reduction of distribution charges, which perhaps were more likely to grow than to decrease. Referring to the different processes in the works, he mentioned first of all gasholders. There had, he said, been considerable improvement made in these, both in the past and quite recently; but he was sorry that the expense of gasholders was still enormous. The advent of the tankless holder had marked a new era. There were capabilities about this which did not obtain with the old type, inasmuch it was capable of being made very much greater in size and capacity. As to purification, though this did not cost much, he thought it might cost a good deal less. Purifiers were what they were a great many years ago. Could they not get something better? Rubber joints had been a help, but the boxes remained as they had been all along. In the removal of ammonia, they were using a tremendous quantity of water. No doubt there had been great improvements in scrubbers, and so on; but the process was the same as it used to be—they were making a big volume of weak liquor. In the matter of condensers, there had been the introduction of the water tube. Personally, he believed in the old type of atmospheric condenser; but in certain circumstances there was better control of temperature with the water tube pattern. In the design of these, however, the fact was frequently overlooked that they were exposed to corrosion. Some new condensers had been tried in Sydney, where the problem was an acute one. They used sea water which, in the summer, was at a temperature of 75°. With this new type, the gas was forced through from small diameter tubes, and it was found possible to cool the gas down to 60°, although the inlet water temperature was 75°. This seemed a step in the right direction. Condensing, however, was not a very serious matter.

CARBONIZATION AND THE NEED FOR SAVING HEAT.

The main thing was the carbonizing plant; and here they were in some respects just where they were a century ago. They were still working with fireclay retorts using a large percentage of the coke to heat them. How much of this heat went through the walls to the interior of the retort? A very big proportion was dissipated by radiation. There was a big field for saving heat. Of course, there were verticals available now; but it was still the same thing—trying to get heat to go through brick walls. Alluding to the Maclaurin plant, he said he thought there was something in this particular process. He understood it to be doing excellent work at Nuneaton, producing 200 B.Th.U. gas; and he thought they should investigate more fully than they had done some of these new producer plants. They must place the gas industry in an unassailable position; and to do this, it was necessary to have cheaper production. It seemed to him that it was only on these lines they could succeed. When one considered the capital expenditure that had to be put down for any form of modern retort bench, it must be realized that it was out of all proportion to the results obtained from it.

PURIFICATION.

The PRESIDENT remarked that, in looking over the records of the Association for the last fifty years, he found that there had been only five papers presented dealing with the subject of purification. The majority had been in connection with retort house working. This seemed rather to indicate that their attention had been focussed a little too much on the retort house. On the other hand, of course, it had to be borne in mind that the retort house was the place of generation of the commodity of which they had to dispose. No means must be neglected of producing gas more economically.

Mr. P. N. LANGFORD (Coventry) said that, though it might be true that the purifiers themselves had remained the same for very many years, there had been developments, and developments were still taking place, in the methods of working them, which tended to prolong the life of the material in the boxes. There was one important point with regard to the cost of manufacture to which he would like to draw attention. They were all aware that the cost of manufacture was dependent to a very large extent on the net cost of coal; and this in turn was greatly dependent upon what they obtained from residuals. The most important residual was coke; and here there was plenty of room throughout the industry for effecting a reduction in the net cost of coal. There was a vast field for coke awaiting development; and if the gas industry did not take advantage of the opportunity, the coke oven people would. Proper plant should be installed for grading the coke into suitable sizes for different purposes, and openings should be found for it. At Coventry they graded and washed their coke for domestic and industrial uses. He had not personally seen the plant at Nuneaton; but it had received consideration in the past, and was well worthy of consideration now. One had, however, to go into matters of this kind very deeply. On the face of it the proposition sounded very fascinating; but if they came down to 200 B.Th.U. gas, the cost of distribution must be increased enormously. A decision as to whether such a course would be economical for the gas industry generally could only be arrived at after full study of the whole of the facts and of their bearing upon the balance-sheet.

MANUFACTURING OPERATIONS PROGRESSING.

Mr. C. H. WEBB (Stourbridge) said he had not yet been converted to the new type of tankless holder; the spiral-guided holder seemed to be as good as anything. It appeared to him that the thing to aim at was to make the load so steady that the gasholder would become of diminishing importance over the twenty-four hours. Probably the reason why there had been so few papers on purification was because the cost of the process had already been reduced to a minimum, and considerable advances had been made which had removed most of the difficulties. In the matter of condensing, it would be interesting to know how one could get gas down to 60° with water at 75°. Vertical retort carbonizing results seemed to him to be pretty good at the present time; and on the whole he thought their manufacturing methods were progressing, and that they had every reason to feel they were moving in the right direction. Mr. Wilson had not mentioned waste-heat boilers, for instance. Again, at Stourbridge they had just installed a rotary wagon tippler, which would save them hundreds of pounds per annum. In many subsidiary processes moves forward were being made.

Mr. F. C. BRIGGS (Dudley) said it was most necessary that it should be made plain that things were not really as Mr. Wilson had represented them. As to waterless holders, he hoped they were not going to increase in size. Personally, he rather looked to storage in vessels under high pressure as being the way out, if means could be found of compressing the gas more cheaply. Certainly progress had been made in purification. In his own case, he had enormously increased the work of his purifiers simply by altering the operating methods. It was going to be a costly matter to distribute 200 B.Th.U. gas with their present systems.

HEAT-RESISTING METAL ALLOYS IN THE RETORT HOUSE?

As to the heating of coal in the retorts, one could not help wondering whether it was too weird a dream to think that heat resisting metal alloys would help them in their retort houses. If one could conceive a vertical retort made of such metal alloy, which would stand high temperatures, one would see at once what a saving could be obtained. Again, how many of them would not jump at a reasonably priced purification system that would remove the whole of the sulphur from the gas? If they had gas dry and absolutely free from sulphur, it would assist them enormously in the solution of one of their distribution problems; and therefore a process that could be operated at a reasonable cost would be extremely valuable.

Mr. W. B. MCLUSKY (Halifax), the President of the Manchester District Institution of Gas Engineers, called upon by the President, said he was very pleased to have an opportunity of addressing the meeting. He thought that, in connection with this discussion, it would be perfectly correct to describe Mr. Wilson as having adopted the rôle of "devil's advocate." He (the speaker) was in agreement with the view that gasholders were ugly things; but in the majority of towns it should be quite possible to hide them behind groves of trees. If they would consider a little more the amenities of the dis-

trict, they could do much to improve appearances. He believed it would not be long before they had a gas which would satisfy Mr. Briggs; and if it would satisfy Mr. Briggs, it would satisfy him. He (Mr. McLusky) was brought up in a country where there was no sulphur in the gas. Perhaps he might point out to them that Dr. Carpenter had designed a new condenser, and it was a very good one. It did not occupy a great deal of space, and it brought the gas into close contact with the cooling medium, which was water.

Gas Low in Cost To-Day.

The price of gas was very low to-day; but unfortunately the consumer did not know that, because the undertaking added a lot of things to it which were not the cost of gas at all. He asked whether any of them knew, from their own experience, of any low-grade gas that could be made at a less price per therm than high-grade gas—net coal, less residuals. Proceeding, Mr. McLusky pointed out that gas selling at the lowest price was not necessarily the cheapest from the point of view of works cost. There were probably members present making gas at less; but they could not sell it at the same price. He wanted both the domestic load and the industrial load; but (say) 200 small domestic consumers would use more gas in the year than one industrial consumer with the same maximum hourly demand. The only difference was that on one hand were 200 accounts to collect, 200 meters to survey, and 200 service pipes. At Halifax they used their holders to the extent of six hours' production per week. This was because of the way in which they had developed the domestic demand. As to prices, there was no longer any necessity to discriminate between night and day demands, or lighting and non-lighting loads. They would get all Mr. Wilson wanted, if they sold gas at the price of gas, whatever that might be, and told the customer what he had to pay per week or quarter for service. There were little houses in Halifax at rents of from 4s. to 7s. per week which were using 3000 c.ft. of gas weekly, or 150,000 c.ft. a year. "Could I," asked Mr. McLusky, "sell that gas, if I did not sell it at the price of gas?" The consumers paid for gas, and only paid the fixed charge once.

Mr. Wilson, in reply, said he had opened the discussion with the idea of inducing the members to think over things. Dealing with the points that had been raised, he remarked that the very name "waste-heat" boiler was wrong, for there should be no heat wasted. In carbonization they were really only at the beginning of things; but this beginning had lasted for a century. It was a great pleasure to study Mr. McLusky's method of charging for gas. Some of them must be rather lacking in courage, or they would have gone further than they had done in this matter. Mr. McLusky's desire was that everything should be clear and above board, so that the consumer should know exactly how much he was paying for gas, and what he paid for his service.

The President, proposing a vote of thanks to Mr. Wilson, agreed that another term ought to be applied to waste-heat boilers on retort settings as at present arranged. It was really surplus heat.

Mr. Morland seconded the vote; and this closed the proceedings.

PRESIDENTIAL ADDRESS OF W. B. McLUSKY, ENGINEER AND MANAGER TO THE HALIFAX CORPORATION GAS-WORKS.

Manchester District Institution of Gas Engineers, March 1.

The programme of the proceedings for the year is well in hand. The Council have arranged for papers on engineering subjects and the control of process work; and one or two gas-works in the district will be visited.

To-day we are to have a discussion instead of the usual address. The subject is the sale of gas, the parts which compose the price, and how these parts are made greater or less.

We shall see the effect of:

(1) Low "works cost" and small consumption per service pipe.
(2) Moderate costs of production and large consumption per service pipe.

We might have paused, you may say, to consider the effects of dear coal and other materials, and low prices for tar and other bye-products. We might have complained of the persistent production and dumping of coke-oven coke, and the proposal that the authorized manufacturers and distributors of gas in statutory areas of supply should become mere retailers. Reference might also have been made to the fact that public utilities in proportion to their revenue are heavily rated and overtaxed, and that in some cases these charges alone are equal to 29s. per week per man employed; but we must pass on to

The Sale of Gas.

He is a good salesman who foresees the needs and provides for the demands of his customers well in advance. He was a great Dutch philosopher who said:

> If my foresight had been as good as my eyesight, I would have done things differently.

The great improvement in gas appliances in recent years, and especially during the past year, has given gas a fillip. It is our job to scrap the old appliances and instal the latest and most efficient.

Economy in the production of gas is only a good start. Service to the consumer and economy in the use of gas are the only satisfactory results. We must plan to reduce the consumption of gas per appliance, and get more appliances installed. When the customer finds that gas appliances are saving his pocket, he will spend money on more appliances; and the consumption of gas per service pipe will increase.

Saving and selling are essential parts of our work. We may save a penny by producing an additional therm per ton of coal carbonized. That is an achievement; but if we can sell the therm, that is a greater achievement, and we shall earn fivepence or more.

The cost of production is remarkably low, but the selling price is not—mainly because the consumption of gas per service pipe generally in this country is less than it might be.

The consumption of gas per inhabitant is also low. Therefore every 1000 c.ft. of gas sold is sold at a relatively high cost for distribution and overhead charges. The reason is that nearly every house, office, factory, workshop, and public building in this country is provided with a supply of gas, and the needs of these customers are satisfied with a small quantity. It is different, for example, in the United States of America, where the proportion of gas accounts in a town is not so large in relation to the population as in this country, and where the individual accounts—even ordinary accounts—are higher than ours. A greater amount of business is done on a large scale; consequently the average consumption per customer supplied is large.

In Baltimore, for example, where the first Gas Company was established in the United States, the sale of gas per inhabitant is 13,700 c.ft. per annum, or 7 p.ct. higher than that of the City of Washington. These I am credibly informed are the best figures produced by our friends on the other side.

The following are among the best in this country:

Birmingham	14,500 c.ft.
Bath	14,500 ,,
Scarborough	12,500 ,,
Derby	11,500 ,,
Huddersfield	9,800 ,,

Birmingham and Bath, it will be agreed, are exceptional.

The following figures regarding Halifax may be interesting:

Gas, 8066 c.ft. per inhabitant. Electricity, 292 B.O.T. units per inhabitant.

The figure for electricity includes tramway traction, which accounts for 25 p.ct. of the business done.

When a low consumption is accompanied by rather heavy capital commitments, a flat rate has too much to carry. Here is an example:

Capital employed per customer supplied, £10.

Interest and sinking fund	16s.
Distribution	10s.
Total per annum	26s.

If the average consumption of gas per customer per annum is only 26,000 c.ft., this undertaking is burdened with 1s. per 1000 c.ft. for the above items alone. Do you wonder that the price of gas is high in some towns?

With a low "works cost" and a consumption of 50,000 c.ft. to 60,000 c.ft. per customer, the price of gas will be low in spite of considerable expenditure of the kind referred to. Take for example the following:

Example A.—A Large English Gas Undertaking.

"Works cost"	1s. 5·47d. per 1000 c.ft.
All other expenses, including distribution, rates, rents, and taxes, and charges for interest and sinking fund	£3 6s. 8d. per annum per customer supplied.

The consumption of gas per service pipe is 61,788 c.ft., so that the average cost from the gasholder outlet amounts to only 1s. 0·94d. per 1000 c.ft. of gas supplied. The average selling price is roundly 2s. 6d. per 1000 c.ft., and all costs and charges beyond the gasholder outlet absorb only 40 p.ct. of the income, compared with 72 p.ct. in the case of electricity undertakings of considerable magnitude with a load factor of over 33 p.ct. These figures show that the selling price can be low with a "works cost" that cannot be described as low.

Here is an example of a low "works cost" and a relatively high selling price:

Example B.

"Works cost"	1s. 3d. per 1000 c.ft.
All other expenses, including distribution, rates, rents, and taxes, and charges for interest and sinking fund	2s. 3d. ,, ,, ,,

The consumption per service pipe in this case is only 30,000 c.ft. The average selling price is 3s. 6d. per 1000 c.ft., so that

costs and charges beyond the gasholder outlet, amounting to 2s. 3d. per 1000 c.ft., absorb 64 p.ct. of the revenue. This case proves that low "works cost" alone will not make the price of gas low.

There are a number of gas undertakings in this country in a position to sell gas at low prices, because the capital employed is low and the volume of gas sold per customer is high. I dealt with this point particularly in a paper I read to the Institution of Gas Engineers in 1926.

There are undertakings in a position to sell gas at 1s. 6d. per 1000 c.ft. and less, if the customers would pay fixed charges amounting on the average to 1s. per week. In small houses the fixed charge would be lower, of course; but in the larger houses and in business and industrial premises the fixed charges would be greater—according to the maximum demand or the size of the premises.

In some towns the commodity charge would be more than 1s. 6d. per 1000 c.ft.; but even if the commodity charge amounted to 2s. 1d. per 1000 c.ft., or 5d. per therm, the terms would still be attractive.

What would the consumption of gas per service pipe be if the terms were sufficiently attractive? Here is an example from actual experience:

	Per Annum. £ s. d.
Fixed charge, 13s. per quarter	2 12 0
Commodity charge, 150 therms at 5d.	3 2 6
Total	£5 14 6

An electricity account for the same size of premises:
Assessable value, £25.
Fixed charge per quarter for electricity supply, 12s. 6d.

	Per Annum. £ s. d.
Fixed charge, 12s. 6d. per quarter	2 10 0
Commodity charge, 4350 units at ½d. (150 therms)	9 1 3
Total	£11 11 3

Who shall say that gas has anything to fear from competition. Gas at 5d. per therm defies competition; and, as I have shown, many undertakings are in a position to sell the commodity at a lower price than that. What is the price of the competitive commodity?

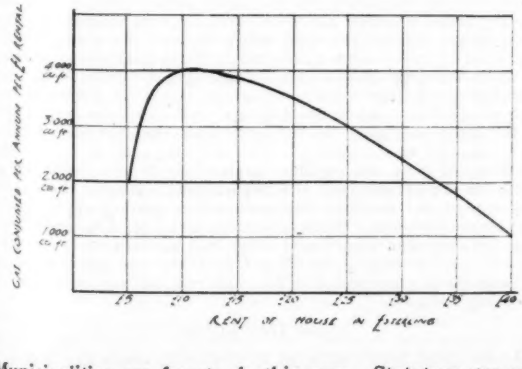
A first-class industrial town with a good mixed business in industrial, commercial, and domestic supply shows a "works cost" of 0·368d. per B.O.T. unit, equivalent to 10·672d. per therm. Distribution, rent, rates, and taxes, interest and sinking fund charges, *less* meter and motor rents, cost 0·972d. per unit, equivalent to 28·188d. per therm. The total cost is 1·340d. per unit, equivalent to 38·860d. per therm or 16s. 2d. per 1000 c.ft.

In one of the largest cities in the country the average price received is 1·36d. per unit, equivalent to 39·44d. per therm, or 16s. 5·20d. per 1000 c.ft. This undertaking has one of the most efficient generating stations in Great Britain.

The item for fuel (coal alone) in efficient generating stations to-day amounts to 0·180d. per unit. It is obvious that the cost of generation cannot be further reduced; and if the cost of distribution could be entirely eliminated, the "works cost" alone, which, as we have seen, is equivalent to 10·682d. per therm, would be too high to compete with even village gas-works supply.

The incidence of the high cost of distribution on the units sold is the main drawback. The "demand" is high, but the "load factor" is low. One of the most progressive electricity supply undertakings in the country has a load factor of under 35 p.ct. The incidence of these high distribution charges can only be reduced by improving the load line, and electricity at ½d. per unit *plus* a moderate fixed charge is tending in that direction.

We must improve our load line too; and we can do this successfully and profitably if we sell our commodity at "works cost" *plus* interest and sinking fund charges on works, and collect a quarterly "fixed charge" to meet all expenses and charges beyond the gasholder outlet, in the way I have shown.



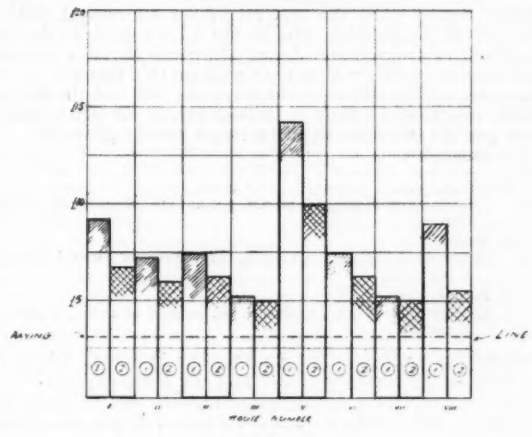
Municipalities are free to do this now. Statutory gas companies are not so free. The municipality may pay interest on capital employed without reference to the price charged for gas.

A statutory company is not in that position yet, unfortunately; but it is hoped that the difficulties and restrictions in the way will soon be removed.

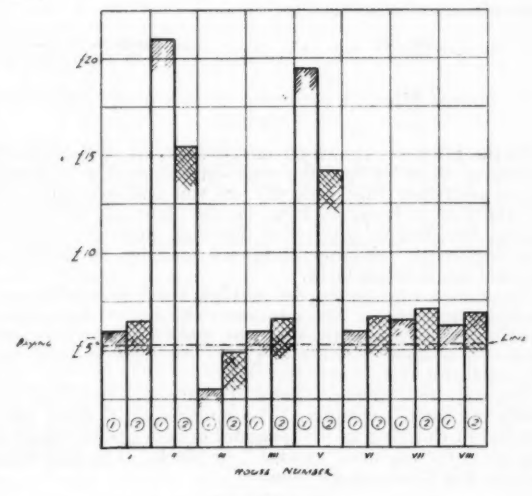
Municipal gas undertakings are, however, faced with restrictions too. The municipal gas salesman realizes this when he meets his colleague from the municipal electricity undertaking

Halifax Flat Rate and Alternative Two-Part Tariff.

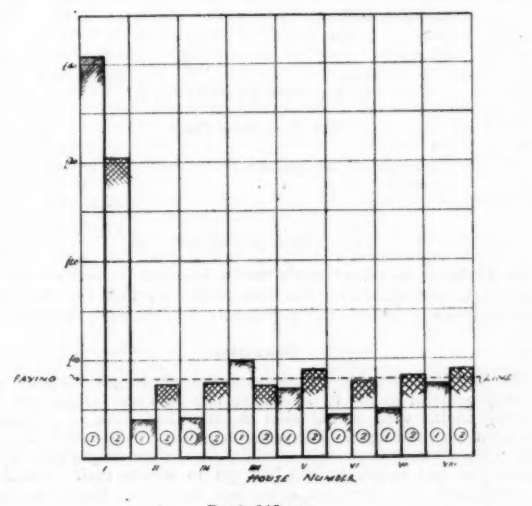
Charts showing amount of account for like volumes consumed—
(1) Flat-Rate; (2) Two-Part Tariff.



Rent £10 p.a.



Rent £25 p.a.



Rent £40 p.a.

in competitive work. Not every member of a municipal body can be described as an enthusiast for gas; and the gas salesman must be one who is always ready and willing to understate his claims. When he does this he has the strong support of the

Council in every effort he makes to keep his customers and secure new ones.

To keep and satisfy our customers should be our first care. Are we not liable to neglect the great body of inhabitants of towns whose custom is not greatly sought after by our competitors? Concentration on this work yields a quick return. In many quite small houses in Halifax the consumption of gas is now as much as 3000 c.ft. per week, and in some of the large houses 10,000 c.ft. Many of our best customers are users of electricity for lighting. Every customer has his predilections, and we shall fare better if we do not overstate the case for gas.

You will be interested to know that in Halifax nowadays the smaller houses yield the best return on the capital employed. The rent of the premises may be but a poor guide to the size of the house or the volume of gas which one would expect to be consumed in such premises; but at least this figure will convey some idea of the difference between the sizes of the houses to which reference is made. Houses rented at £10 contribute more per £1 of rental than the larger houses generally.

For example:

(1) Rental, £10.
Consumption of gas, 40,000 c.ft. per annum, or 4000 c.ft. per £1 of rental.

(2) Rental, £25.
Consumption of gas, 75,000 c.ft. per annum, or 3000 c.ft. per £1 of rental.

(3) Rental, £40.
Consumption of gas, 40,000 c.ft. per annum, or 1000 c.ft. per £1 of rental.

These are self-contained houses, but in towns where there are flats or tenements we have had the same experience. The rooms in a tenement house are in regular use, but only a proportion of the rooms in a self-contained house are regularly used. When a multiple tariff is introduced, the occasional rooms are used to a greater extent.

The "remunerative" figures in each of the three following examples may be interesting:

Rent per Annum.	The Revenue should be per Annum. £ s. d.
(*a*) £10	3 1 6
(*b*) £25	5 5 11
(*c*) £40	8 0 7

In the examples shown on the charts some of the accounts—including those on the flat rate—are above the paying line. Some are below; but generally, as you will see, the accounts for the row of houses set out on the chart are far above the paying line, mainly because of the large quantities of gas used and the larger amounts of money paid by those who have adopted the multiple tariff.

Customers who accept the multiple tariff invariably use gas in large quantities. The customer who cannot be satisfied in the matter of price is the one who makes a large demand and uses only a small quantity of gas. The multiple tariff has no attraction for such customers.

The objection to most scales of charges is that they do not reach the small consumer. The multiple tariff does; and this method of charging meets competition better than a high starting price for the first "parcel" or block. The following examples will illustrate the point:

(1) *Standard Requirement*, 6000 *C.Ft. per Quarter.*

	£ s. d.
6000 c.ft. at 4s.	1 4 0
6000 ,, ,, 2s.	0 12 0
Total	£1 16 0

Average price per 1000 c.ft., 3s.

(2) *Two-Part Scale.*

	£ s. d.
Fixed charge per quarter	0 12 0
12,000 c.ft. at 2s.	1 4 0
Total	£1 16 0

Average price per 1000 c.ft., 3s.

In Halifax we start with much smaller parcels—as low as 2000 c.ft. per quarter—and the price charged for the second and last parcel is only 6d. per 1000 c.ft. less than the first.

Discussion.

Mr. W. M. Carr (Stretford) said the whole gas industry would be very grateful to the President for this address. It pointed to the writing on the wall, and showed the time had come to get out into the open with the fight. When municipalities were unduly favouring electricity departments, the officials who were responsible for the production and supply of gas had got to say to their Committees: "Gentlemen, you must act fairly and honestly. Where we offer a cheaper and better service, you must say so. You cannot sit in the Gas Committee to-day and in the Electricity Committee to-morrow, and face both ways." If that was done, and it was made known throughout the country that they insisted upon a fair and square deal, they would get it. For instance, it was not desirable that the electricity department should be pushing electric cookers in houses where gas cookers could do the work more cheaply. Public money was wasted by such competition; and those who were custodians of the public money were responsible for the waste. He was speaking now entirely of municipalities.

An Iniquitous Practice.

Standing charges had been referred to. In many municipal undertakings a burden had been put round their necks by including in the price of gas the cost of apparatus. It was an iniquitous practice, because the man who burned the most gas, who made the greatest use of the service, paid the most for his apparatus; the man who made the least use of it paid the least. Suppose the standing charge in respect of so-called free apparatus was 1d. per therm. Obviously, the man who burned 240 therms would pay £1 in rental for his apparatus; the man who burned 24 therms only paid 2s. for exactly the same apparatus. That was absolutely unsound, and the members should have the pluck to say so. It might be said, "If you make a separate charge the people will not have it, and you lose a certain amount of consumption." Well, an examination of the accounts of municipal undertakings showed that their load factor was not improving—that, in fact, it was getting worse. The total quantity sold might be greater, but the consumption per consumer was generally less. A lower load factor meant that the price would go up eventually; and in the long run the public were losers.

Costing of Industrial Charges.

Another factor referred to was the industrial field. There crude oil was a potent competitor. Thousands of tons of crude oil were burned in furnaces which could profitably use gas, and ought to do so, because thereby employment would be given to British miners instead of British money being sent to America to pay for oil. ["Hear, hear."] There must be a revision of the system of costing so far as industrial charges were concerned. The flat-rate system was not applicable. They must take a leaf out of the book of the electricity people so far as industrial supplies were concerned. He would give an example. In a certain undertaking the cost into the holder, including all charges, was 2·3d. per therm; distribution costs amounted to 2·1d. per therm; the standing charges in respect of interest and sinking fund (much of which was for money expended on apparatus in consumers' houses) was 3·4d. per therm. From the gas-works a main could be laid almost into an industrial works which would consume probably 50 million c.ft. per annum. With some of the very big users of crude oil that figure would be attained if gas displaced oil. The cost of the distribution in such a case would be something like 0·2d. or 0·1d. per therm. If that user was asked to pay a price which included the 2·1d. per therm for distribution costs, instead of the 1d. or 1·2d. which was the actual cost of distribution in his case, he would not agree to the proposition; they could get hold of him if they supplied heat units at a price which approximated to the actual cost. Then the user could afford to put in gas; and he would gain the advantage of having a fuel which was cleaner, easier to work, and better controlled than oil. An ordinary manufacturer costed out his various jobs. He only put on a particular job the cost of supplying that particular job. They must follow suit in gas. The President had mentioned that municipal undertakings could put into operation the multiple part tariff. He was afraid he could not quite accept that suggestion, because in the municipal undertakings they were working under the old fixed maximum price basis, and they had not the power to say to the consumer: "Pay us for our service 10s. per quarter, and we will sell gas at 2½d. or 3d. per therm." That was what the electricity people were doing; but they themselves could not do it. However, the President had given a very good lead to the industry, and in saying he very much appreciated the address, he was voicing the opinion of every member present. [Applause.]

Mr. W. J. Smith (Bolton) said he had taken out figures in his district to see how they compared with those given by Mr. McLusky in his synopsis. Certainly Bolton produced electricity cheaply. Where 5000 units were used the consumer could obtain current at 0·616d. per unit, which was a fairly low figure to compete against, but certainly not as cheap as gas. It was equivalent to gas at (say) 1s. 6d. per therm, or 6s. 9d. per 1000 c.ft. There was another scheme in Bolton under which the consumer took so much current for lighting at 4½d. and the rest for power at a lower figure; that worked out nearer to the figure the President gave for gas. There was a system of charging according to the number of rooms in a house. A man might go from a house with six rooms into a larger house, which he could get almost as cheaply, and his electricity, which cost him 1·27d. in the first house, would cost him ½d. per unit more in the second house. For gas the cost would be increased from 2s. 9d. to 3s. per 1000 c.ft. As Mr. Carr suggested, the load factor was not increasing but was being rather reduced. On several housing schemes which had been carried out in Bolton, the average consumption was 12,490 c.ft., which reduced the average domestic load from 17,030 to about 13,000 c.ft. The consumption per consumer on these housing estates varied from 8500 to 16,800 c.ft. In the Horwich district there were two estates similar in size of house and type of occupant, and in one both gas and electricity were installed, in the other only gas. In the latter case the average consumption per consumer was 20,111 c.ft.; in the first case it was 8743 c.ft. Evidently it was not possible to maintain both supplies in small houses to the advantage of the Departments. Neither the Electricity Department nor the Gas Department was getting anything out of that housing scheme. Where gas alone was laid, it was worth while, and the consumer contributed something to help the rates. When he also used electricity he did not do that; nor would he do so if he was given gas apparatus free—he had not the money to spend on using the gas.

The Dice Loaded.

To his mind the competition by electricity which they had to face was almost immoral. There were variations in pricing from 4½d. to ½d., and the man who paid 4½d. provided a fund for the advantage of the other. But he was afraid gas engineers would have to take a leaf out of the electricity book. In Bolton they had a method

which combined a sliding-scale according to the amount of gas used with a fixed charge according to the size of the house. He had got the figures of average consumption from 1924 to the last financial year, and there was an increase in every class of house:

For houses with four rooms . . .	11,817	in 1924 to	13,737 c.ft.
Five or six rooms.	17,057	,, ,,	18,348 ,,
Seven or eight rooms	28,777	,, ,,	33,835 ,,
Nine to 12 rooms	49,032	,, ,,	55,919 ,,
Thirteen rooms and over	71,196	,, ,,	89,447 ,,

Mr. McLusky had given 14,500 c.ft. as the consumption per inhabitant in Birmingham; that left Bolton rather in the cold with 6000 c.ft. per inhabitant. It was a deplorable figure; yet the Electricity Department was allowed to send its representative to the consumer of gas and advise him to take out the gas cooker and replace it with an electrical cooker. If that sort of thing was carried to the logical conclusion, and the gas-works was closed down, the Corporation would be saddled with the burden of providing for interest and depreciation in respect of the nominal capital. He felt that the conclusion to which the President's address pointed was that they must get busy and consider their charges, and try something on the lines adopted by the electricity people. [Applause.]

Mr. F. H. Robinson (Harrogate) said it seemed to him one of the most important points was the average consumption per consumer. In Harrogate it used to be about 39,000 c.ft. per year; but six small undertakings had been taken over where the average ranged from 9000 to 20,000 c.ft., and the effect was to reduce the Harrogate figure to something like 33,000. They had tried to raise it. In one district where the average had been 9000 c.ft. per meter they got it up to 16,000 c.ft., chiefly by supplying apparatus on reasonable terms. He did not fully agree with Mr. Carr in ruling that out. With Harrogate, it was mostly slot meters; and the rent for the apparatus was the money put into the coin box. In that way they got a return on the capital they had to provide for the purpose. To his mind it was a most crucial point—by all means increase the consumption per consumer in order to lighten the burden of the distribution charges.

Slot Meter Difficulties.

Mr. H. Davies (Chesterfield) believed many of the members present were in much the same position as himself, though perhaps it was not quite as bad—75 p.ct. of his consumers were of the slot-meter type. It would be interesting to know how Mr. McLusky would put a multipart tariff into operation in such a case. Mr. Carr's remarks about the price charged to large industrial users were out of place. Surely most gas undertakings nowadays recognized the value of that load and provided for it by substantial discounts or differential prices. In Chesterfield, during the last twelve months, a method of charging had been operating under which the charge was 10d. per therm for the first 10 therms; 8d. per therm for the next 40 therms; 7d. from 50 to 100; 6d. above 100, with a discount of 5 p.ct. The slot meter consumers jibbed at it; and their dissatisfaction resulted in a considerable loss of revenue. Unfortunately tram and bus fares had had to be put up, in order to meet the loss on that undertaking; there was an uproar about that, and the feeling extended to the charge for slot meter gas. The meters had to be fixed so as to get the first 10 therms at 10d. per therm. Any surplus due to the operation of the lower prices on larger quantities was returned in discount. In some cases there was a drop of from 22 to 14 c.ft. for the penny. The consumers did not actually pay at that rate, because they got a substantial discount; but they felt they were being mulcted in a very high charge and they would not use the gas. He mentioned this as a warning. Where there was a large number of slot meter consumers he thought there would be great difficulty.

A Four-Part Tariff for Brighouse.

Mr. C. R. Ingham (Brighouse) said the Institution were much indebted to the President—not only for his address, but for what he had been saying for a quarter of a century with regard to a revision of the methods of charging for gas. He (Mr. Ingham) was afraid he did not agree with what Mr. Smith had said about the "almost immoral" charges of some electrical undertakings. On the contrary, he thought gas men should take a leaf out of the electricians' book, and reform some of their own immoral charges. His own undertaking had just introduced an optional four-part tariff for the sale of gas used for industrial and trade purposes. It was hoped this would increase output and improve their load factor. He realized that the scheme did not cover the whole field by a long way. It was not claimed to be a model, and would be modified as experience dictated; but it was based on scientific principles. He agreed with the whole of what Mr. Carr had said on the subject of competition with other fuels for industrial and trade purposes.

Mr. F. V. Barnes (Todmorden) remarked that, being a neighbour of Mr. McLusky, he was constantly in touch with him, and had followed his example by introducing a two-part tariff in August, 1927. Slot meter consumers were put upon it automatically. For the first 3000 c.ft. they got 21 c.ft. for a penny; over the 3000 they had 30 c.ft. for the penny. As the meters were not altered, there was a large rebate; and many consumers purchased apparatus with the rebate on their money. The adoption of the two-part tariff was optional. The scale in simple terms worked out at 8d. per week *plus* 1s. 5d. per 1000 c.ft. for gas (3·94d. per therm). They got down to those figures with the idea that an ordinary 10-in. gas fire would cost about ½d. per hour, which compared very favourably with the cost of a coal fire. There was now in operation both the ordinary block-rate system and the two-part scale. A material increase took place in the consumption by customers who adopted the two-part scale.

Mr. W. J. Smith said he understood what the President was out for was that the consumer should be charged the right price—the amount which it was just he should pay. What he had referred to as almost immoral was the practice of getting an output at a cost of under 1d. per unit and then charging one consumer ½d. and another customer 4½d. It was not fair to the latter; it made him pay more than his appropriate share in order that an advantage might be given to the customer who paid ½d.

Mr. Barnes pointed out that the load factor must be taken into account. Suppose a consumer used current only for a short time in the day, and was one of a small group. The plant required to give him his supply would be standing idle most of the time. Therefore he ought to pay a higher rate. He believed that in Todmorden some customers paid 6½d. per unit for current for shop lighting. In his opinion they got it cheaply.

Mr. J. H. Clegg (Burnley) congratulated the President upon having given an address which provided the members with so much food for thought. In regard to rating, the facts which had been given, although perhaps not very useful, were certainly interesting. He himself for purposes of comparison had taken out the Burnley figures on the basis of cost per workman per annum. It was £35 for the Gas Undertaking; £9 4s. 5d. for the Tramway Department; and £41 15s. for the Electricity Department. In the case of a large textile engineering works it was £2 5s., and for a large mill it was £1 10s. Those were the amounts per annum per man employed. The variations were startling. For some time he had felt there was room for improvement in the method of charging for gas. Whatever system was adopted should be more or less national. The Burnley Electricity Department made a charge of 20 p.ct. of the rateable value. He knew one house which was rated at £42 10s., while another house of very similar dimensions with as many fireplaces in another part of the town was rated at £12 10s. On that rateable basis the Electricity Department would get £8 15s. from the occupant of the first house; 50s. in the second case. Obviously it would not pay the former to have his gas or electricity on the basis of rateable value; and the result was that the only people who adopted that scheme were those who found it would be to their advantage. Therein lay the difficulty. Those people were now unprofitable consumers; the puzzle was how to get more out of them. It was necessary to get a certain income before a customer became profitable. He believed, with a fixed charge of 52s. per annum per consumer, they could easily afford to sell gas at 2½d. per therm. They had a system under which the first 50 therms cost 7d. per therm; over 50 the charge was 6d. per therm; and when the consumption amounted to over 250 therms it was 5½d. For industrial purposes, to meet cases such as Mr. Carr had mentioned, they had special rates.

Consumption and Apparatus Increased by Block System at Burnley.

The reason why that system was adopted was that they expected to rope in the prepayment customers. The consumption was ascertained at the end of the quarter, and rebates were allowed. It had been in vogue for three years; and whereas in the beginning they allowed rebates at the rate of £100 per annum, the amount had increased to £1000. A steady growth of consumption by prepayment consumers had taken place. The sales of apparatus had considerably increased. During January, 1929, the net number of cookers sent out was 114; there were 293 gas fires, 258 gas boilers, 7 water heaters, and 5 radiators. In all, 677 pieces of apparatus were sent out during that month. In January, 1927, the corresponding figures were 192, and in January, 1928, 212. The increase was brought about by the co-operative efforts of everyone in the Gas Undertaking. The first thing necessary was to have a Central Showroom; then a live staff was needed to deal with the sales; and the work must be well supported by propaganda in every possible form. Methods used by other people had been adopted, and they had some of their own—lectures, exhibitions, and the like. There must be a proper maintenance scheme, facilities for obtaining apparatus on easy terms, and the fixing must be done cheaply. They did not favour simple hiring. That was only done with gas boilers, which were let out at 1d. per week. But then they had been brought up against another problem. When the pipes and mains were laid, the object was to provide a service for perhaps two flat burners in the house with an average consumption of (say) 8 c.ft. per hour. Now that the consumption was 55 c.ft. per hour the question of pipes and mains was a serious problem. The consumption per consumer had increased tremendously; but the very large momentary demand reduced the load factor. The distribution system was not devised to meet the present-day demand, and would have to be improved. He believed what was happening in Burnley was happening in other towns, or would do so in the near future.

Mr. J. Mottram (Ossett) asked the President to explain how monthly gas accounts affected a two-part tariff.

Mr. H. Curtis (Macclesfield) said that in the undertaking he represented they had been trying to attain a commodity charge, by charging various prices, without making a separate tariff charge. The scale was: Up to 40 therms, 40 to 100, 100 to 250, 250 and over. The maximum price was 11d. per therm. For four years in succession the prices had been reduced by ½d. per therm. Of course that gave a better discount to the larger consumers. Four years ago he submitted to his Committee details regarding a certain number of free cookers which had been fixed consecutively. The figures were taken irrespective of where the cookers were fixed; and to his surprise the extra consumption through them amounted to only 1000 c.ft. per annum. In the Committee, persons who represented the class of people to whom those free cookers were supplied disputed the figures, so records were taken of another batch of free cookers. To their surprise again the figure obtained was less than the previous one. Thereby proof was given that it was not a sound financial proposition to put in free cookers haphazard, just as people wanted them; and it was decided to make a charge of 10s. towards the cost of fixing. It was surprising how that 10s. charge stopped all illegitimate applications for free cookers. In the last three years not one cooker had been bought by the Department for fitting on free hire. To compensate for that they had a clause to the effect that all consumers who used over 40 therms per quarter would be allowed ½d. per therm

discount. They had succeeded to this extent—that in 1927 (compared with 1926) there was an increase of nearly 100 p.ct. in the turn-over in cookers and appliances sold by the showrooms. For 1928 the figure was approximately 75 p.ct. The members would realize that meant that in future the maintenance charge on apparatus out was going to be materially reduced.

Macclesfield Rates.

They had two rates of charge in Macclesfield—ordinary and power. They assumed that any industrial user would be brought into the lower scale of charge. A power consumer was assessed upon the maximum load the engine took. They considered it was not fair that a man who had a 60 H.P. gas engine but only used 45 H.P. with his maximum output should be assessed on the basis of 60. When the consumption of gas per quarter did not amount to 60 p.ct. of the assessment there was a flat-rate charge of 6½d. per therm. When it amounted to 60 p.ct. the maximum price was 6d. per therm, and it went down to 4d. Last June they introduced an innovation which was working out as anticipated; but he was not yet in a position to state definitely the actual effect. They started to give differential rebates or discounts for the summer and winter loads, with the idea of increasing the load factor of the undertaking, and thus reducing the burden of the standing charges. They thought that if the summer load could be increased sufficiently they could afford to give 25 p.ct. discount on the scale of charge during the six summer months, and 5 p.ct. upon the winter months. Up to the end of November they had an increase of 8 p.ct. The December consumption was a little less than the consumption in the corresponding period last year, which he thought was accounted for to some extent by climatic conditions; and then in January they had an increase of 10 p.ct. Of course the figures could not be taken as an average under the conditions which had been experienced. When the whole of the consumers were under one tariff, everybody under the same heading, the cost of the clerical work was less.

Mr. H. Singleton (Huddersfield) had taken out some figures in order to see whether he could arrive at some scheme to compete with their Electricity Department, which was supplying current at ½d. per unit *plus* 15 p.ct. on the assessment. He ascertained that if the gas consumers paid a penny per day (30s. per annum) as a service charge, the gas could be sold at 5d. per therm. Alternatively, with a uniform service charge of 10s. per quarter, it could be sold at 4d. per therm.

A vote of thanks to the President was proposed by Mr. Robert Watson (Doncaster), who observed that he could add hardly anything to what had already been said. They all concurred in thanking Mr. McLusky for his admirable address. Even those who did not altogether agree with him about the particular method which should be adopted would admit it was good for the gas industry that this question of the best way to charge for gas should be considered. It should stimulate the members to consider the modification or adjustment of their own methods.

Mr. E. Astbury (Liverpool) having seconded the vote of thanks, it was put to the meeting by Mr. R. H. Ginman (Leek) and was carried unanimously.

The President Replies.

In his reply, the President said he agreed with Mr. Carr that oil was a more formidable competitor than electricity. The figures given by Mr. Carr for works costs, distribution costs, and fixed charges amounted to 7·8d. per therm, which was equivalent to 3s. 3d. per 1000 c.ft. Obviously he could not sell his gas to the large industrial user at that rate. In those circumstances the only way to sell gas was to take the works costs of 2½d. per therm and let the customer pay his fair share of the other charges. Mr. Carr had referred to the powers of the municipalities. His (Mr. McLusky's) interpretation of those powers might differ from the interpretation of a learned Counsel, but the position was this. The customer would sign a contract. He would be told he was going to pay so much per week or so much per quarter, and that he would get his gas at a certain price, say 2s. If later on he said he would not pay according to the contract, he need not be forced to do so; but he would be called upon to pay the ordinary price. He would not get it at the commodity price of 2s., but would have to pay 3s. 5d. for it. So it would be as broad as long. The scheme was optional in Halifax—10,000 out of 25,000 customers were being charged according to that method, and not one of them wanted to exercise the option to go off the scale.

Mr. Smith had pointed out how capital was dissipated by the competition of two municipal departments, one supplying gas and one electricity. He believed that it was too costly to last long. In Halifax gas was more popular even in houses fitted for electric light. The occupants had discovered that electricity was dear; they were very well satisfied with gas, and the consumption in those houses was very much better than in similar houses elsewhere. As Mr. Smith suggested, the payment of 4½d. per unit by one class of consumer did provide a fund to a certain extent which enabled the electricity supply company or the municipality to supply energy at a low price. Even if it was sold at a penny per unit, a big profit could be made if the customer would pay an appropriate fixed charge. On the other hand, in some cases electricity might be cheap at 1s. per unit—for instance, if it was used occasionally for an hour or two. The figure of 6000 c.ft. as the average consumption per inhabitant per annum was not bad when one took into consideration how big Bolton was. In a town like Widnes, with a concentrated population, better figures could be got than where, as in the case of Bolton, there was a very large area in relation to population, and every customer had a pipe in his house. Harrogate had a very fine load factor in both gas and electricity. He agreed that it was desirable to retain every customer possible, however small the consumption of gas might be.

Mr. Davies had stated that in Chesterfield 75 p.ct. of the consumers used slot meters. In Halifax the people who used coin meters were charged according to the system adopted by other undertakings. If the consumption in a quarter was below a certain figure, they paid more than the ordinary consumer. Over that figure they paid the same price as any other customer. They could adopt the two-part tariff. He had read Mr. Ingham's report to his Committee, and thought it a better report than any other he had read. He hoped Mr. Ingham would read it to the Institution. He was interested in the block system described by Mr. Clegg. However, he still held the opinion that it was better to quote a low price straight off *plus* a quarterly charge, than charge a high price for the first parcel and a low price for the second. The figures for appliances supplied in Burnley were remarkable. Apparently in a few years time the gas consumers in that town would have invested as much money in gas appliances as the Corporation had invested in the undertaking. In reply to Mr. Mottram he would say that the quarterly payment plan was adopted in Halifax; 400 accounts were made out per day, 2000 per week. The experience of Mr. Curtis went to show that every man could meet the needs of the customers in his own area. He could give them what they wanted, and make a success of it. Huddersfield had a much larger consumption per inhabitant than most other towns; and if Mr. Singleton would adopt the scheme described in the address and sell gas at 5d. per therm *plus* 10s. per quarter, he would do even better than he was doing now.

PRESIDENTIAL ADDRESS OF MR. C. M. D. BELTON, ENGINEER, SECRETARY, AND MANAGER OF THE SHREWSBURY GAS LIGHT COMPANY.

Midland Association of Gas Engineers and Managers, March 7.

Let me first of all express my appreciation of the high honour you have conferred upon me by electing me to the Presidential Chair of this Association. For over fifty years the Association has afforded opportunities for Gas Engineers of the Midlands to meet in order to discuss matters of technical interest; and the roll of Presidents contains not a few names of more than ordinary distinction. Hence the task of preparing an address, rather than a technical paper, is one of considerable difficulty if any new ground is to be broken; so I claim your kind indulgence if I do not satisfy the Athenians among you.

In the course of a perusal of old books and documents belonging to the Shrewsbury Gas Light Company I came across some items which I thought might be of interest to a wider circle than merely local, and I am therefore venturing to give you a few extracts.

On the first page of the original Minute Book, dated January, 1820, is the following:

Advertisement, Jan. 7, 1820.

Gas Lights. Town of Shrewsbury.

The Mayor having received an application from several respectable inhabitants, to convene a meeting for taking into consideration the expediency of lighting this town with gas, requests the friends and approvers of that measure to attend him at the Town Hall on Thursday, Jan. 13, 1820, at eleven o'clock in the forenoon.

N.B.—It is intended at such meeting to propose that a Company be formed for the above purpose; some pains having been taken to ascertain the expense and the probable returns, the particulars of which will be communicated to the meeting for their consideration. The chief motives which induce those who have the adoption of the gas lights in view are the following:

(1) That streets are much better lighted, and afford better security to the inhabitants from nocturnal depredators, and from the nuisances of disorderly persons.

(2) Shops have a stronger and more brilliant light, without the danger that more or less attends the use of candles, and without the injury often arising from accidental dropping of oil.

(3) Private persons have the opportunity of introducing gas lights into any and every part of their houses; at once meeting brilliancy with perfect safety, cleanliness, and elegance.

(4) The almost universal adoption of gas lights proves that they meet the approbation of the public; and from a pecuniary point of view are satisfactory to the proprietors, who have in some instances, it is said, made from 10 to 20 p.ct. on their shares.

Lastly.—From the inquiries recently made, there is reason to believe that the shareholders here will receive a fair annual percentage on the money advanced, at least 6 p.ct., probably considerably more.

Then follow many pages giving a detailed account of the rough, rock-strewn path of progress followed by these provincial pioneers, with several illuminating sidelights upon the difficulties encountered.

Within six months from the time of calling the first meeting of townspeople to consider the project, the Company's first

private Act of Parliament was placed upon the Statute Book. Would that the legal machine were permitted to work with equal celerity in these days! Is there any significance in the fact that the Mayor who called the original meeting was a worthy divine—Rev. Archdeacon Owen—and that the Chairman who presided over the first few annual meetings was also an Archdeacon?

I must give a quotation *in extenso* from the first report to the shareholders.

Extract from a Report of the Committee of the Shrewsbury Gas Light Company to a General Meeting of the Proprietors held at the County Hall on Sept. 15, 1823—the Rev. Archdeacon Butler, D.D., in the Chair.

The first meeting of the Committee was held on Feb. 22, 1820. The Act of Parliament received the Royal Assent on July 8 in the same year; and the Company began to supply the town with gas-light on Sept. 8 in the year following (1821).

The first point which the Committee had to decide upon related to the comparative merits of oil gas and coal gas. For this purpose they entered into a correspondence with Messrs. Taylor & Martineau, and deputed an agent to inspect one of their works which had been erected on a small scale at Liverpool. After obtaining the best information in their power, they finally determined in favour of coal gas, chiefly because it could be supplied to the consumer at little more than half the price of oil gas, and could be made equally pure.

The illuminating power of oil in comparison with coal gas is nearly as $2\frac{1}{4}$ to 1. Oil gas is sold at 50s. per 1000 c.ft. The common price of coal gas is 15s. per 1000 c.ft. Making, then, due allowance for the superior power of oil, the difference in price is as 33s. 9d. to 50s., or about 33 p.ct.

But the Shrewsbury Company charges only 12s. per 1000 c.ft., which makes the difference to be in the proportion of 27s. to 50s., or 46 p.ct.

It is to be observed also that oil gas, as well as coal gas, varies in its illuminating power, according to the quality of the material from which it is extracted, and in its unburnt state gives out an equally disagreeable odour. But there is one inconvenience belonging to oil gas which is worth noticing, and which results from the very property for which it is celebrated. In consequence of its superior illuminating power, a proportionally less quantity is required to produce a given quantity of light. This, of course, makes a small flame of oil gas answer the purpose of a much larger flame of coal gas. But a small flame is more easily extinguished than a large flame—and, therefore, upon a stormy night, the street lamps, which would not exhibit a flame of oil gas equal to half the size of the flame of coal gas, would in all probability be generally blown out.

Having for these and other reasons decided in favour of coal gas, the next business of your Committee was to find out where it was manufactured of the best quality and at the least cost. Among the places visited in order to ascertain this point, Oxford at that time presented the most brilliant and beautiful light from coal; but the method of purifying at Oxford was very expensive, which caused some demur as to its adoption. While deliberating upon this matter, your Committee heard a favourable report of the Derby Gas-Works; and the late lamented Chairman made a purpose journey to Derby with a view to obtaining correct and certain information. Being quite satisfied of these works over all those which had hitherto fallen under their notice, your Committee resolved to engage the services of Mr. Wigston, the Engineer employed at Derby—and accordingly under his direction were set up the retorts, the purifier, the condenser, and the other necessary apparatus at your works at Shrewsbury.

Meanwhile the laying of the pipes was going forward under the management of Mr. James McIntosh, of London, according to a plan which it may perhaps interest the meeting to hear explained.

In order to ensure a supply of gas on the lowest levels of this remarkably hilly town, it was determined to carry an *insulated* main (as it is called) to the bottom of the Wyle Cop, and another to the bottom of Mardol. These mains deliver no gas to the consumer, but merely convey the gas from the works to these lowest parts of the town. The supply is given by *return* mains, which ascend on each side of the street from the extremities of the insulated mains. And in order to make the circulation complete, a line of pipes is carried from the bottom of the Wyle Cop along the walls, and by St. Chad's Church to the lowest point in Mardol. Thus the gas *everywhere* ascends, and the difficulty of getting up and down two hills which intervene between the works and the opposite extremity of the town is entirely obviated.

These peeps into the problems of the past are educative as well as amusing, and the allusions to specific persons and places will interest members associated with the towns mentioned.

Two years later there is another paragraph that will bear quotation.

Extract from Report to General Meeting held on Sept. 19, 1825.

It may perhaps be right to say something respecting portable gas. Your Company have not been inattentive to the contrivances by which gas is made portable in small globular vessels, instead of being conveyed by pipes into the interior of buildings. But the apparatus at present in use is not sufficiently convenient to answer general purposes. It will no doubt be improved; and as soon as it shall be so far perfected as to be applicable to manufactories or public rooms, without the trouble of perpetually regulating the stop-cock, your Committee, if encouraged by the demand, hope to introduce it at Shrewsbury. This subject, however, may be postponed till the next general meeting of the proprietors.

The sequel to this is found in a subsequent report.

Extract from Report to General Meeting held on Sept. 26, 1827.

The correspondence respecting portable gas with intelligent persons

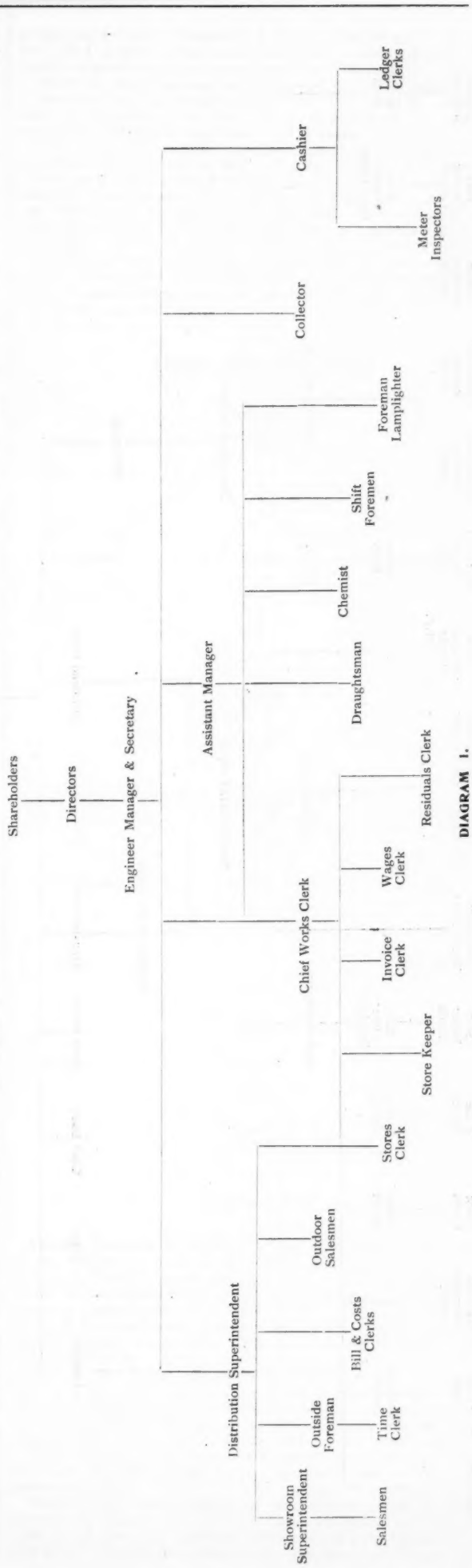


DIAGRAM 1.

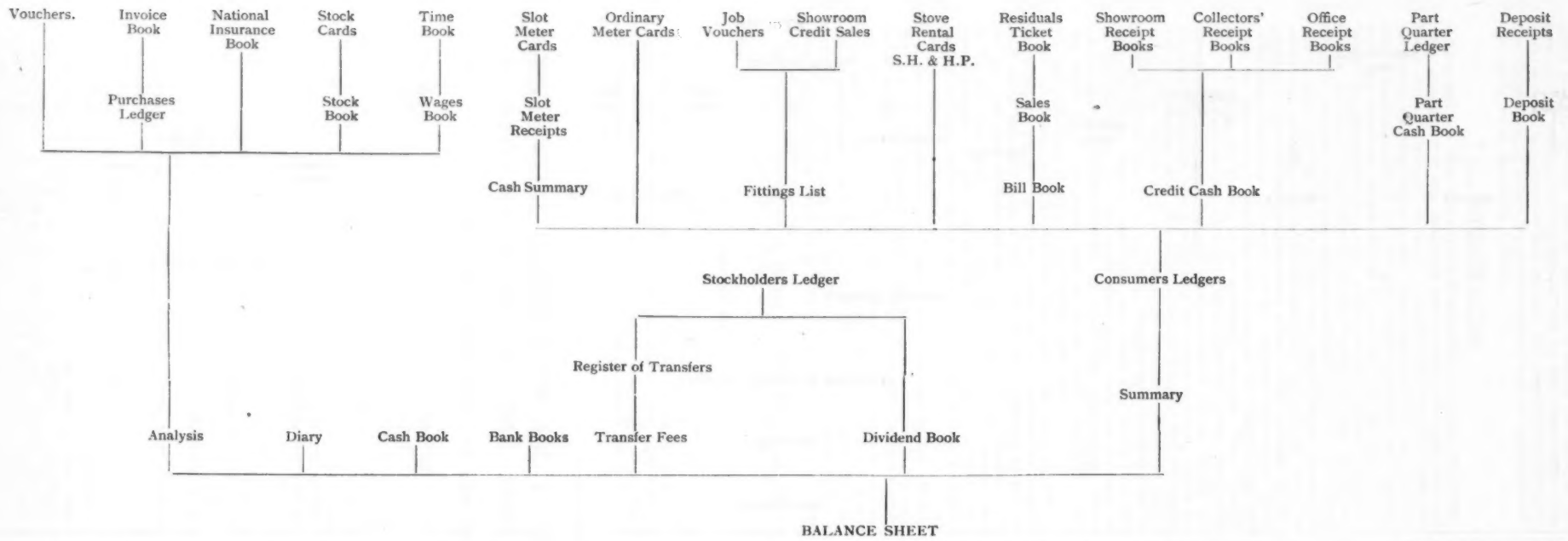


DIAGRAM 2.

in London and Liverpool gives no encouragement for trying it in Shrewsbury.

Six years later there occurs a report which again mentions another Midland town, and marks definitely the transition period from iron to clay retorts.

Having had reason to be dissatisfied with the great consumption of retorts, in making gas according to our system, which is considered the best of those practised, your Committee have long kept an eye on the several attempts that have been made to introduce retorts made of brick. They had seen none that tempted them to abandon the iron ones before the present year; when, upon hearing that there was a successful experiment made at Cheltenham, they sent their Clerk over to inspect the same, and report his opinion thereon. He returned well satisfied with what he had seen, which was a set of retorts built entirely of brick, three of which had been in use for the space of three years, and were still in action. They had entirely discarded the iron retorts, and had none but such as were made of brick. This is so great an advantage that your Committee thought no ordinary difficulties should stand in the way of trying to introduce them at your works; and, therefore, after carefully considering the pros and cons of the question, they finally determined to engage the person who built, and has the management of, those at Cheltenham, to erect three of the same sort in Shrewsbury, by way of experiment. Accordingly, they have put up a building for the purpose; and the Contractor is now daily expected to complete his engagement.

Now note this:

If the Committee should succeed in establishing the brick retorts to the entire exclusion of the iron ones, and if they should answer their well-founded expectations as to their costing so much less, and lasting so much longer, than those which they are at present obliged to use, then it is hoped the Company will be able to reduce the price of gas, without injury to the concern. The newspapers have stated that one of the London Companies has lowered its gas as much as 20 p.ct.—that is, about 2s. per 1000 c.ft. On inquiry, your Committee find that a new Gas Light Company is projected in the City of London, in opposition to that in Dorset Street, which has induced that Company to reduce its rates. There seems to be no regular or fixed price for gas in London or Westminster; prices varying from 15s. to 11s. per 1000 c.ft. But it is highly probable that the stir now making among the companies will cause a considerable reduction of price. But whatever be the charge, unless they greatly improve the quality in London, it will still be very dear.

The person or persons who drafted the first part of this last paragraph must have been taught to be cautious. At any rate their promises were well safeguarded.

But I must not weary you with ancient history, so let me pass over a few years till the formation of the first national association in 1863, called the British Association of Gas Managers, whose inaugural meeting was held in Manchester.

In the printed volume of proceedings, I notice that the first paper presented was by Mr. E. S. Cathels, of Shrewsbury, upon "Gasholders and their Tanks and Connecting Pipes," advocating the use of a common inlet and outlet pipe. The subsequent discussion did not reveal any substantial approval of the idea, but our friend was a frequent contributor to the Association's proceedings.

Mr. Cathels was succeeded at Shrewsbury by a gentleman boasting of the name of Darwin, and to his time I can trace the origin of a species of handicap from which my Company cannot escape by any of the recognized methods of evolution. I refer now to the fact that the works are divided into two sections separated by a strip of land occupied by houses and maltings. There was an opportunity, which cannot recur, some fifty years ago, to purchase this strip of land and property; but unfortunately the Board who then held sway were not imbued with that foresight and optimism which now characterizes gas administrators, and so at present we labour under a grave disadvantage in comparison with most other undertakings. Another serious handicap from which my Company suffers is that both the G.W. Railway and the L.M. & S. Railway are so near that cartage from the yards costs only 1s. 3d. per ton, and yet the intervening property and highways preclude the carrying of sidings into the works, except at such cost as would be quite unjustifiable. Thus it will be appreciated that particular attention must be devoted to the most economi-

cal utilization of engineering plant, and concurrently the best form of administrative organization.

In a medium-sized company there are many advantages to be derived from unified control, principally, of course, in the matter of correlating the interests of the various departments or sections, and regulating the expenditure. I have prepared a diagram showing the organization of the administrative and technical staff of the Shrewsbury Company, which may interest members, though it may not be commonly applicable.

The diagram serves to indicate the channels of responsibility. The designations of the officials will be sufficient to indicate to you their individual duties.

In the days of our callow youth we were accustomed to use the disrespectful term of " old buffer " when referring to the head of the family or business. When the administration of a gas company is concentrated in one ubiquitous individual he must necessarily become a " buffer " in the real sense, between the various groups of people vitally concerned in the prosperity of the company, whose interests do not necessarily run on parallel lines. They are the shareholders, who require regular and substantial dividends; workers who require regular work and wages; and consumers who require gas of regular quality and pressure, supplemented by service on a broad and generous scale. It is just here that the true spirit of co-partnership can do so much to keep the wheels of progress and prosperity in working order. The more intelligent co-partners realize their duties as well as their privileges, but, for some, I fear co-partnership begins and ends with the receipt of the annual bonus.

Modern methods of business organization must be developed to their full extent in large undertakings; but it is also quite advantageous to adopt and modify works and office systems in an up-to-date manner for smaller concerns.

I have here a graphical representation of the main features of our book-keeping system. This illustrates the method of obtaining and collecting the various statistics and accounts required to furnish a complete annual statement and balance-sheet in the form prescribed by our venerable acquaintance, the Act of 1871.

I do not know that there are any particular novelties, but perhaps I may indicate a few general principles. All payments are made by cheques which are drawn at monthly Directors' meetings, with the exception that weekly cheques are required for wages and for petty cash including insurance stamps. All accounts due for payment are scrutinized by myself before the monthly list is made up, to see that the preliminary checking of detail has been properly carried out.

All cash received is banked daily, and a summary made out showing the details of receipts through various channels.

A method known as the duplicate posting system has been found extremely useful for checking automatically the entries from receipt books into ledgers, avoiding the use of large cash books, and involving merely the posting of daily totals from the various receipt books into a cash summary. I have also found this system equally useful in posting from residuals ticket books to ledger. In each case the entries are proved at once, thus obviating the search for errors at monthly or quarterly balancing times.

Here it may be useful to try to demonstrate by means of a diagram the " goods inwards " system.

You will see from this that proper control is exercised over the purchase of all goods, and the checking of quantities made complete by the use of requisition form, order form, goods received form, and contractor's invoice. The requisition form is made out by the stores clerk when the stock is approaching a pre-determined minimum, or by the works or distribution department, when other items are required, and thus the respective departments are safeguarded. A carbon copy is retained by the issuing department, the original being passed to me and then attached to the order duplicate and sent to stores. A daily return of " goods received into stores " is made out in triplicate, one for each department; the stores clerk receiving with his copy the fulfilled requisition, and passing forward with invoice to invoice clerk.

The stores clerk is entirely independent of the stores; and his records are not available for the storekeeper. A continuous system of stocktaking is employed which obviates the disorganization commonly associated with such an affair when occurring annually. The storekeeper is given a short list of articles each day, and has to record his actual stock opposite each item. This list is returned to the stores clerk for checking with his record on the stock cards. Annual stocktaking simply means listing the balances at current prices on the stock cards. These balances are the difference between the goods received (as recorded from the daily return form) and the goods issued (entered from another form also furnished by the storekeeper).

In addition to the primary books of account indicated upon the diagram, there are, of course, numerous statistical records which are necessary for daily, weekly, monthly, or quarterly information, and which are not of the balancing type. These are kept on forms, on cards, or in books, according to the degree of permanence of their utility. Comparative information is often best exhibited in the form of a chart. The value of charts to those who are accustomed to reading them depends upon the right choice of scales in order to show the results in proper perspective. Personally I make extensive use of charts, as I find graphical representation often reveals features not readily appreciated by a mere inspection of figures.

Elaborate book-keeping machines and costing machines are a necessity in large undertakings, but even small to medium sized undertakings can find useful employment for adding machines, addressing machines, and a variety of typewriters.

A detailed analysis of all the figures appearing in the annual statement of accounts is kept on large linen-backed sheets. These show, among other things, the allocation of capital expenditure year by year, the revenue items per 1000 c.ft. made and sold and per ton of coal and equivalent. These records are complete for fifty years back, and form a valuable reference file. Since records in terms of thermal units became available, it is apparent how much more valuable they are than when the volume basis alone was relied upon. Comparisons between different undertakings are now possible with some certainty of the figures approximating the facts.

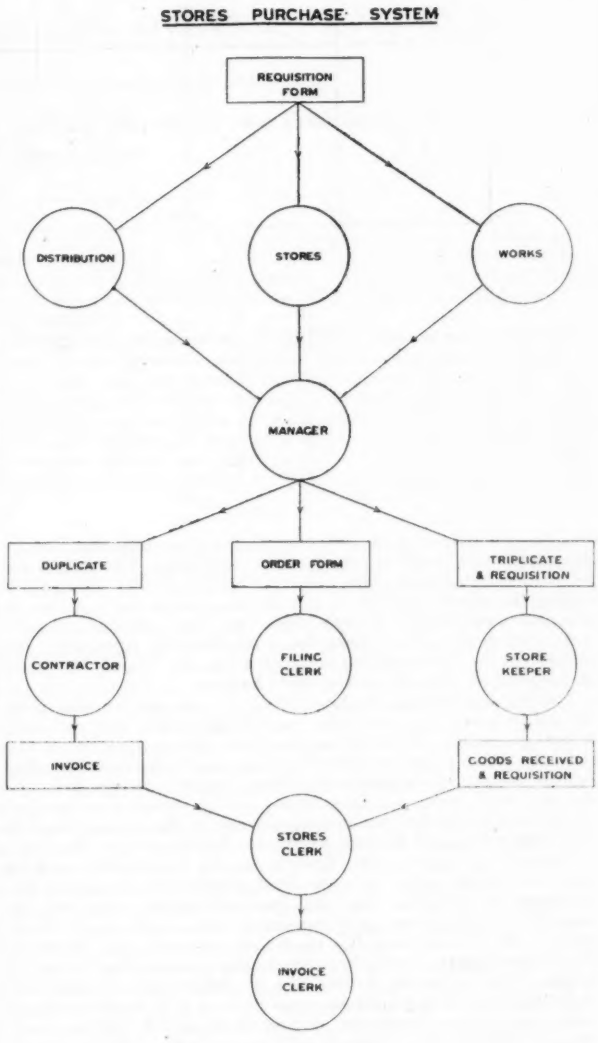


DIAGRAM 3.

For the purpose of obtaining a bird's-eye view of the state of the industry in so far as may be indicated by statistics, the Board of Trade Returns are very useful; and this usefulness would be considerably enhanced by a reduction of the period elapsing before publication. The Form of Return from 1920 onwards is rather more complete than that of 1919, 1914, and previous years; no Returns being available for the years 1915 to 1918 inclusive.

One or two points emerge from a study of these Returns which, it seems to me, may be worth referring to just now. The percentage of total sales credited to prepayment, ordinary and power, and public lamps, worked out from the last eight Annual Returns are shown in the table on the next page.

These figures show remarkable steadiness; the only considerable alteration being a very creditable decline in unaccounted-for gas.

Another noticeable feature of this 8-year period is that, though the sales of gas have increased by 44,200 million c.ft. (18·8 p.ct.), the coal used has increased by only 137,000 tons (7·8 p.ct.). This is due partly to the increased use of water gas

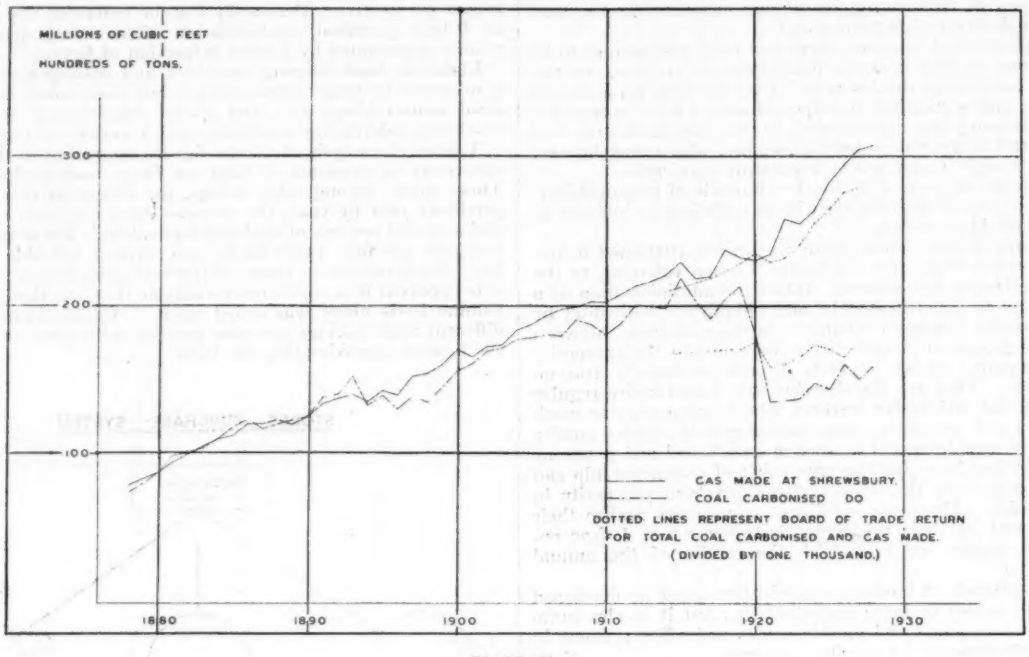


DIAGRAM 4.

—	P.Ct. Prepayment.	P.Ct. Ordinary and Power.	P.Ct. Public Lamps.	P.Ct. Unaccounted-for.
1920 . . .	30·3	58·6	2·7	8·4
1921 . . .	32·3	57·0	2·8	7·9
1922 . . .	31·0	58·0	3·3	7·7
1923 . . .	31·7	57·8	3·4	7·1
1924 . . .	32·2	57·7	3·5	6·6
1925 . . .	32·7	57·5	3·5	6·3
1926 . . .	33·5	56·9	3·1	6·5
1927 . . .	33·4	57·4	3·3	5·9

plants, and partly to improved carbonizing results obtained by the adoption of vertical retorts with steaming. I have charted the figures relating to Shrewsbury for the last fifty years, indicating the steady growth in gas made, and on the same chart the coal carbonized. Where these two lines separate, I have also plotted on a scale 1000 times smaller, the figures for the whole of the undertakings included in the Board of Trade Returns; and these show the same feature.

Taking the average make of coal gas per ton as shown by the returns—viz., 13,900 c.ft.—and dividing this into the total water gas made, it would appear that this process saved the industry some 3,391,000 tons of coal in 1927; the corresponding figures twenty years previously being 10,900 c.ft. per ton, and the coal equivalent 1,978,000 tons. If the industry is not prepared to pass on the threatened increase in the price of coal to gas consumers, still further economies will have to be devised.

Comparing again some figures of the latest Return with those of twenty years ago, the total number of consumers has increased by 62 p.ct., the total gas sold by 67 p.ct., but the average consumption per consumer has only risen from 31,120 c.ft. to 32,260 c.ft., equivalent to 3·68 p.ct. increase. Both these figures, however, include the consumption by public lamps. The separate figures are available only for the last eight years, and show an increase of 1·44 p.ct. in the average consumption per consumer during that period. This would seem to indicate that there is still a very wide field for propaganda, salesmanship, and service, in order to *intensify* the consumption of gas. One significant feature revealed by the figures must be apparent—viz., that whereas a large increase in the number of consumers implies extensive capital outlay in mains and service pipes and meters, an increase of consumption per consumer might be secured by other and less costly methods, chargeable to revenue.

On the engineering side, I had the honour of reading before you some time ago a paper dealing with the modernization of the carbonizing plant at one of our works at Shrewsbury. Reference has also been made to the performance of this plant in a paper recently given to the Midland Junior Gas Association. The pressure-raising and general gas distribution system at Shrewsbury has also been referred to in detail by the President of that Association. There is, therefore, not very much that I need mention now preparatory to your visit to the works in the spring.

Our water gas plant has been adapted to the back-run process, and the increased capacity of the plant has been so useful that the additional capital cost will be more than repaid within the year.

A coke grading plant of the reciprocating screen type has been added to the vertical retort plant, and has enabled us to obtain many new customers; the coke being particularly clean and dry. The following is an average of a large number of analyses of the three grades:

—	Moisture.	Volatiles.	Ash.
Large coke	1·40	2·11	8·65
Medium, 1 in. to 2 in.. . .			
Nuts, ½ in. to 1 in.. . .			

Our own boilers require all the dust we make, and some of the nuts in addition.

The condensing, washing, scrubbing, and purifying plant is of the ordinary type, and the only comment one can make is that practice in these phases of manufacture does not seem to have made progress at all comparable in proportion to the vast improvements in carbonizing. It may be true that dividends are made in the retort house, but at the same time it is equally true that they are often decimated before the gas has traversed the gamut of mains, vessels of all shapes and sizes that constitute a gas-works, and the distributing pipes.

Gas Dehydration Plant.

Last summer a plant of the Holmes type was installed for the partial dehydration of gas, between the holders and the station governors. Owing to the lay-out of the works, it was not practicable to arrange this prior to the holders; but by using a large tower scrubber packed with earthenware "propellor" fillings, the minimum of pressure is absorbed by the apparatus, being, in fact, less than 0·2 in. water for maximum output. The whole of the distributing system has now been dried out with the exception of extreme points where consumption is very small, and one or two places where there is slight infiltration from water-logged ground. The dew-point tested at widely separated points of the district has been found to correspond within very close limits to that at the outlet of the plant. I hope that when the Association meets in October next it will be possible to have a paper and discussion upon this process, as by that time experience will have been long enough to justify some definite conclusions.

I consider a well-equipped chemical laboratory to be of great importance upon a gas-works, in order that the fullest information may readily be obtained with regard to raw materials, and primary and secondary products. The expense of maintaining such a laboratory and the necessary staff is well worth while, as it is only by this means that proper and continuous control of processes can be exercised, thereby ensuring the desiderata of regularity of supply and constancy of quality.

Scientific instruments for indicating and recording a variety of physical and chemical conditions are now available for use in all parts of a gas-works; and these are of considerable assistance in the proper control of operations. Some discrimination has to be exercised in the selection of these aids to efficiency, as they are not universally applicable for their primary purpose under all conditions. Frequent calibration and regular inspection are essential for the best results; but

if the instruments receive a modicum of expert attention, they will give invaluable service.

VALUE OF THE TECHNICAL PRESS.

I would like to state here that I consider the gas industry is fortunate in its Technical Press on several counts. Readers are kept fully informed concerning all the latest developments in connection with manufacturing processes, distribution systems, legal and Parliamentary affairs, and are treated to the personal opinions of editorial writers on topical subjects connected with the industry. In fact, the whole field is so well covered, especially when reviewing in the New Year the events of the Old, and forecasting future developments, that any address in the nature of a survey given at this time to men in the profession must be more or less a repetition or paraphrase of something that has already appeared in print; so I will not attempt anything of that nature.

The general feeling of optimism in the industry, as revealed by the recent speeches at gas companies' meetings, is a very healthy sign in face of the severe competition of rival forms of fuel, the spoon-feeding of the electrical undertakings, and the reluctance with which bare justice is given to us, either locally or nationally.

The usefulness of this and other Associations will be materially increased by free and frank discussion of topics of general interest or problems of particular interest, if every member will realize that he has something to contribute to the aggregate of knowledge and experience. I would therefore appeal to members to come forward voluntarily with offers of papers, or even merely to open a discussion upon any subject of immediate interest to the Association, for it is only by pooling our ideas that the industry as a whole can hope to maintain a worthy progress commensurate with its importance to the nation.

PERFECTING MODERN GAS OVENS.

By ARTHUR FORSHAW, M.Sc., Chief Chemist to Messrs. R. & A. Main, Ltd.

Before the Midland Junior Gas Association on Feb. 14, under the Presidency of Mr. F. Caudwell, of Shrewsbury.

[Extracted.]

After some opening remarks Mr. Forshaw went on to give a brief description of the oven tests of the Institution of Gas Engineers (Trans. Inst. Gas Eng., 1923-24; "GAS JOURNAL" for July 2, 1924). He thought that these tests had not been made the best use of by the gas industry, for whom they were devised. They had been responsible for considerable progress in oven design by the appliance makers. By using these authorized weapons in a suitable manner, the effect of alterations in design and construction could be ascertained, and progress or the opposite be made manifest.

He then mentioned how he had made use of them in testing and perfecting the "Conservor" oven of his firm, which was characterized by a bottom-flue vent from the oven, and two burners. Discussing the effect of this form of construction, he said: First as to the improvement in efficiency. Taking an ordinary top-flued "Maintenance" oven at random, a mean of two tests gave a figure of 600 B.Th.U. per sq. ft. per hour. This is a fairly average figure for this type of oven with enamelled sides and linings.

After converting the oven to "Conservor" with bottom flue orifice or vent leading into the flue space between the back lining and the outside back, two tests gave an average of 455 B.Th.U. per sq. ft. per hour. This is a saving of over 24 p.ct.

Some further interesting figures for two similar ovens are the comparative temperatures at various points and the consumption of gas to maintain them. These are as follows:

Top-Flued Oven.				"Conservor" Oven.			
Consumption, C.Ft. per Hour.	Temperatures, ° Fahr.			Consumption, C.Ft. per Hour.	Temperatures, ° Fahr.		
	A.	C.	E.		A.	C.	E.
5·3	201	194	163	5·3	225	217	219
7·9	261	250	201	8·7	313	304	298
10·5	313	300	241	11·2	370	361	345
13·2	369	351	288	13·5	426	415	390
17·7	444	430	354	17·5	532	509	460
24·0	547	536	432	24·7	644	622	581

Examination of these figures will at once show two outstanding facts about the "Conservor"—viz.:

(1) That for equal gas it gives a considerably higher A, or top temperature, so that even the E, or bottom temperature, is notably higher in the "Conservor" oven than the A temperature in the top-flued oven (conversely, for equal A temperatures it requires considerably less gas).

(2) That the difference between A and E, the extreme top and bottom temperatures, is very much less.

You will further notice that comparison of the three A temperatures in each oven shows that the drop between A, the top, and C, the centre position, is very similar in both ovens, and that the big difference between top and bottom in the top-flued oven is accounted for mainly by the difference between C, the centre, and E, the bottom, and that therefore in the ordinary top-flued oven there is a bottom zone of lower temperature. This is worth noticing, for the above results indicate that no special form of oven is required to get the two-zone effect. An interesting confirmation of this statement will be found in the Institution Report in Appendix 12, in which temperature readings, taken at five different levels in a top-flued oven, are given, and the influence of the area on them is discussed. There is also a curve (fig. 8, Appendix 17) with readings taken every inch from top to bottom of an oven. Both these show how the lower parts of a top-flued oven are at a lower temperature than the upper parts.

Altogether it will be realized that the "Conservor" oven is shown, by the figures I have given, to be exceptionally even in temperature, and to have a much improved figure of merit. We also found by various cooking tests that in this direction it was also an improvement on a top-flued oven, for food was more evenly cooked, no browning shelf was required, meat did not require basting, and baking and browning of cakes could be carried on in any position from top to bottom of the oven.

"SMOTHERING."

I have left until last the mention of its performance from the point of view of the heating-up and smothering tests, because these lead me to the new work I wish to lay before you. It is clear, when we consider the difference between a top-flued oven and one with a bottom exit position for the products of combustion, that the question of possible smothering will require carefully watching. Smothering is due to products of combustion being forced down to the level of the flames and mixing with the oncoming secondary air which is necessary to complete the combustion. If a top-flued oven smothers under the Institution test, it is usually an indication that the flue-outlet is too small; and the defect can be cured by increasing the flue area. In a bottom-flued oven the products of combustion are purposely forced down towards the burners; and on the circulation of the products upwards and then downwards depend the special advantages of the bottom-flue outlet. You will see that, if the flue-outlet is too low, smothering may result; whereas if it is too high, some of the advantages already enumerated will be to some extent sacrificed. As constructed, however, all "Conservor" ovens at the works passed both the Institution tests and had a factor of safety of at least 60 p.ct.

This was the original "Conservor" oven as placed on the market early in 1925, while previous to this a large number of slot-cookers had already been converted to the "Conservor" bottom-flue exit principle. I may say that it more than justified its adoption, and was—and still continues—a very successful appliance indeed.

THE TRIAL OF PROLONGED USE.

Those of you who have experience of the marketing side of gas appliances will know that, however successfully an appliance may show in the hands of its producers or when tested by a gas undertaking, it cannot be considered as absolutely perfect until it has passed the test of prolonged use in the hands of the general public. The original "Conservor" oven was no exception to this rule. Its very high efficiency was, in fact, a source of trouble at first; and for this reason—that consumers and gasfitters had become accustomed through long years to the ordinary top-flued oven. When setting the consumption, the fitter had always been used to a certain length of flame. This was necessary in the old ovens to get quick heating-up. I may say that a great number of ovens, if examined and tested, would be found to heat up in three to five minutes, instead of the twelve minutes of the Institution tests. These might still pass the subsequent smothering test because they were provided with top-flues of considerable size; but the plain fact is, of course, that generally speaking no such test had ever been applied to them. So long as they did not smother

when full on, as set by the fitter, no further trouble was taken with them. At any rate the old ovens were set to burn very often some 35 to 45 c.ft. of gas per hour, when full on. The result was that gas was wasted in two ways—viz., during the heating-up, because a much higher temperature was obtained than was necessary, and because a few minutes' neglect meant a considerable proportion of gas burned to no useful purpose; and during the cooking, because the large flue outlet caused a considerable "chimney effect" when the gas was reduced, and so cold air was drawn through the oven and discharged heated without the heat carried by it having done any work. The user therefore became accustomed to a certain size of flame for the cooking. When setting a "Conservor," which is much more economical in gas, the fitter naturally gave it the long flames to which he had become accustomed, and so tended to cause smothering. The user, again, regulated the size of flame to the accustomed length for cooking, and got so much higher a temperature that food was occasionally burned. We met these difficulties by reducing the size of the burner drillings. Roughly speaking, the old flame length was now given by about half the original consumption, and the difficulty was thus to a large extent overcome.

Had this been all, my present paper would have been considerably curtailed. After some two years' experience, however, we found that, of the number of ovens sold, there was a very small percentage of complaints which could not be traced to these causes. To put it briefly, the complaints were of a tendency to smother. The extraordinary feature of these cases was that, while no ordinary manipulation of burners, and so on, appeared to effect a cure *in situ*, yet when returned to the laboratories for investigation the ovens were always found to be entirely satisfactory, and passed both H and S tests, generally with ease.

This pointed to some local condition either of the gas supply or of the situation as the cause of the trouble. I may say at once that a sufficient number of cases did not come to my notice to enable me to determine the exact reason for the tendency, and why it should be absent under laboratory test at our works. One case would not persist when removed from the user's premises to the local gas-works, another in some other district would show the tendency whether at the user's premises or at the local gas-works; while, as already remarked, neither of these persisted when sent back to the works for test. Whatever the reason for the tendency, it was clear that steps must be taken to guard against it; and the following is an account of the research carried out—and successfully—with that end in view.

Research Work on "Smothering."

We made our preliminary experiments on two ovens which had shown the tendency to smother both on the user's premises and at the local gas-works, but which, tested at our works, had factors of safety of just under and just over 100 p.ct. compared with the necessary 60 p.ct. required by the S test.

We also had a similar oven with a glass door which easily enabled useful observations to be made which otherwise would have been difficult. The most interesting and suggestive information that this glass-fronted oven afforded was with regard to the course of circulation of the products. This was traced by introducing thick white chemical smoke through tubes in various positions. You will remember that the "Conservor" oven, being interchangeable in wearing parts with its corresponding top-flued oven in our "Maintenance" and "Mainstay" series, had two burners with the usual horizontal flames. When smoke was introduced near the top edge of the door, it did not mingle with the gases in the centre of the oven, but immediately streamed downwards from the end of the tube until it reached about the level of the bottom flue exit. It then turned through a right-angle, and made its way directly towards the exit.

This particular observation appeared to account for the fact that, if sufficient gas were burned, smothering always took place first on the front teats of the burners. The downward stream of products would be forced at the front below the level of the flames, and so could mix with the on-coming secondary air, whereas further back the strong upward stream of products from the burners themselves would hinder or delay the action, and any downward stream on the side linings would be returned upwards again. With horizontal flames facing towards the centre of the oven such a downward stream does exist on the side lining, and is returned upwards until the consumption is sufficiently high to force the products right on to the flames. When this happened there was a marked and sudden worsening of the smothering, and half the burner might become suddenly extinguished, while very little more gas would extinguish the whole of one burner.

These observations give point to the remarks on smothering in Appendix 5 of the Institution Tests, where it is stated that, after the stage is arrived at where one or more flames become permanently extinguished, a further slight increase in pressure (*i.e.*, consumption of gas) is usually enough to cause the complete extinguishing of one burner.

With this information to help us, we tried the effect of a burner shield designed to project horizontally forward above the flames, and so to deflect the downward stream of products of combustion towards the centre of the oven, where it would be swept to the flue outlet by the current of products which we had discovered there by our smoke test.

We made it of sheet iron with one edge bent over at a right angle. This narrow edge was forced between the enamelled lining and its retaining strip on the cast-iron base, thus holding the broader shield horizontally in position over the burner with a projection beyond the existing base casting. This device was fairly successful. For instance, we set an oven to smother badly by opening the injectors until 58 c.ft. per hour was being consumed. Without shields, half the right-hand burner and four flames on the left-hand burner went right out. After the shields had been fixed, the right-hand burner flames burned correctly, while on the left-hand burner one flame only went out. The N.M.C. of this particular oven on an H test is about 20 to 22 c.ft. per hour; and to pass the S test it would have to burn about 32 to 35 c.ft. per hour without smothering, at which it would, of course, have a factor of safety of 60 p.ct.

It actually had a factor of 80 p.ct. without the shields, and the use of the shields increased this to over 170 p.ct.—in other words, the shields doubled the factor of safety.

This might have been thought to solve the problem with which we were faced, but it must be remembered that this particular oven, with a factor of safety of 80 p.ct. at the works, had shown the smothering tendency when it was fixed under the unknown local conditions at the consumer's premises. There was no guarantee that the tendency would not show even with the factor of safety doubled. There were other considerations which led us to make a further investigation. For instance, even though they do not smother, as defined in the Institution Report, all two-burner ovens with a good figure of merit ("high efficiency") show signs at high consumption of the presence of products of combustion at the lower levels. Thus the flames are apt to lengthen and sometimes "stagger" or jump, though none of them may leave their teats permanently. Conditions of this sort, while they may not be in any way dangerous, are, however, often alarming to the user, or even to the fitter; and we were determined that, once having taken this investigation up, we would try to produce such an oven as would not only pass its tests with ease, but also give no excuse for alarm to the most nervous user.

Even Oven Temperature.

In first considering this matter, it appeared fairly obvious that, if the products could be withdrawn more quickly from the oven, they would not have time to reach burner level at all, and so no question of lengthening, let alone smothering, could arise. Unfortunately, it appeared no less clear that any measure which had this effect would also tend to destroy two very valuable features of the "Conservor" oven—viz., the very even temperature and the high "efficiency." At that time we ourselves regarded even oven temperature, and have ever since continued to regard it, as a very desirable attribute of a gas oven. We therefore laid it down that our research had for its object the production of a "Conservor" oven so improved that it would be fool-proof with regard to smothering under any possible conditions of use, and at the same time the improved oven must be at least as efficient and as equally heated as the then existing one. We also laid down a condition—not a new one this, but a continuation of our settled policy—that the improvements must interfere as little as possible with standardization and interchangeability of parts.

In spite of the belief, already expressed, that quicker removal of the products of combustion would also result in a lowered efficiency, we felt it necessary to try the matter out, and with this end in view we made a number of alterations to the two ovens I have mentioned.

Mr. Forshaw then went on to describe in detail the alterations made to the two ovens in question, and the result of them on the S and M tests. He showed that, as expected, increased flue accommodation resulted in more air being drawn into the oven; and while the factor of safety was greatly increased, the efficiency—*i.e.*, the figure of merit in the M test—was thereby adversely affected. The various alterations amounted in all to about ten. In commenting on these and their results, he remarked:

From these results it is clear that, as we endeavour to improve the smothering test in this way, we reduce the figure of merit. This result was confirmatory of our previous reasoning. It will be remembered that our main task was to improve the S test; and in this connection what has already been said must be again emphasized—viz., that all two-burner ovens when altered to give a higher efficiency, whether by adopting the "Conservor" principle or by reducing the flue outlet in top-flued ovens, show a characteristic lengthening of the flames at high consumption. This means, of course, that the forcing of the products of combustion to a lower level in the oven causes a certain proportion of them to mix with the on-coming secondary air.

You will realize, then, that these highly efficient ovens always have a constitutional tendency towards smothering; and even if they do not smother under the Institution test, they show the symptoms of their tendency in lengthened flames. This being so, any measures for improving the factor of safety, as have already been described, are what may be called cures.

The tendency to smother when "cured" is always latent in the types of high-efficiency ovens described. What was obviously required was not cure of an existing tendency, but the prevention or eradication of the tendency altogether.

With this object in view we studied the subject afresh. From what I have already said, you will remember there is a sort of secondary circulation of products up from the burners and down the walls. At ordinary consumptions this stream returns upwards again as it approaches burner level. If the stream becomes strong enough, it breaks through its ordinary boundary and overwhelms the flames, causing dangerous smothering. The success of the burner shields was due to their cure of this break-through; but, of course, the secondary circulation down the walls still continued. Our next efforts were directed to preventing, as far as possible, this stream of products down the walls.

For this purpose we prepared No. 3 oven, which was exactly similar at the start to Nos. 1 and 2 already mentioned. In this we put burners with vertical flames. Our object was to keep the products moving upwards in contact with the side walls, and so to prevent the secondary circulation already mentioned. With these vertical burners we also made a number of other experiments.

Here Mr. Forshaw again described in detail the seven or eight alterations made, using vertical burners. It was, he said, found necessary to use baffles of some sort to get the most satisfactory results from vertical burners; but in discussing the experiments he observed:

From these results it is apparent that vertical flame burners of themselves are an improvement, and from the point of view of smothering act as preventatives. It must be emphasized that, even when forced to smother by burning gas at high rates, the general appearance of the flames still alight was good. They did not lengthen appreciably, and they retained well-defined inner cones, all in marked contrast to flames from horizontally directed teats.

As far, then, as smothering went, we felt we had solved the difficulty. Two devices had been found in conjunction with the vertical flames to give remarkably good results. These were, as you have heard, vertical baffles and horizontal baffles.

It now remained to determine whether these preventatives of the smothering tendency could be made to satisfy the other conditions, some of which I have already mentioned, that we had set ourselves—viz.:

1. Unimpaired or improved figure of merit ("efficiency").
2. Unimpaired or improved cooking performance.
3. Interchangeability with previous ovens.
4. Unimpaired convenience to the user.
5. Unimpaired ease of production in quantity.

It will be understood that some of these could not be settled with the existing experimental ovens. Some information about No. 2 (cooking performance) could, however, be gained from them. We therefore baked a number of batches of bread, four loaves at a time, using several experimental ovens against a standard "Conservor" of the same size. Our conclusion was that the vertical flames gave better results.

The next step taken was to find the effect of the efficiency of the two sorts of baffle with vertical flames. With this end in view we cast two oven bases, B and C, with such alterations as would enable the two forms of baffle to be compared simultaneously with a standard base A containing the usual horizontal flame burners. On these bases were built ovens lettered similarly. Later on, as you will see, other ovens lettered up to J were prepared and tested. It would take up too much time to describe in detail all the tests carried out with all these ovens. In regard to M tests alone I have records of no fewer than 115 results during the course of which the effect on the "efficiency" of all manner of alterations was tried out. I shall therefore have to confine myself to the general results and to one or two typical cases.

"Efficiency."

The figure of merit of a standard "Conservor" oven from stock was found to be 420 B.Th.U. per sq. ft. per hour. The mean of fourteen subsequent tests of A oven showed a figure of 422·3 B.Th.U.

Against this, B and C ovens were eventually, after minor adjustments such as distance between burner centres, height of burners, distance between baffle and flame and between baffle and oven side, found to give figures slightly better. Thus the mean of six tests of B was 414, while C showed 412 B.Th.U.

These results established that vertical burners correct in detail, whether vertically or horizontally baffled, improved the efficiency of an oven slightly as compared with horizontal burners. Confirmation was obtained by taking ovens A and C and exchanging their respective horizontal and vertical burners. In these circumstances the mean advantage of vertical burners over horizontal ones, taken over a number of tests in each condition, was 24 B.Th.U. per sq. ft. per hour for A, and 20 B.Th.U. for C.

Smothering Tests.

It was clear that, before going on to design bases for production, we must make up our minds between the two forms of baffle—vertical or horizontal. As both have already been shown to have a satisfactory "efficiency" when the requisite details are attended to, differentiation must be sought in some other way. With this in view we carefully went over the smothering tests of the various modifications of B and C, and made a comparison of the results of the M and S tests.

Mr. Forshaw then described a further number of alterations and tests leading eventually to a factor of safety of about 150 p.ct. and a figure of merit of about 395 B.Th.U. per sq. ft. per hour. In further considering these devices, he went on to say:

If either of these ovens was given an excessive gas consumption in order to cause smothering, it behaved slightly differently from the other. Thus, one first showed signs of smothering in the centre while the other showed them at the ends. A further point of practical importance was that, when provided with vertical baffles, the burners were difficult to remove, and their flames were to some extent hidden from view, particularly at low consumptions. In these circumstances we came to the conclusion that the vertical baffles would not be a practical solution of our problem, however good they might be as an experimental solution.

We therefore concentrated on the horizontal corner baffles, and made them the foundation of our next pattern, which was to be less experimental and more practical than the previous purely experimental ovens.

In thinking over the experimental results and the means by which they had been achieved, we came to the conclusion that we could combine the good effect of the vertical baffles (which gave the higher efficiency and protected the centre flames in drastic smothering tests) without their defects, with those of the horizontal corner baffles, if we connected the latter by means of an inclined curtain from front to back. As eventually carried out, this curtain ran the whole inside length of each burner, and was at an angle of roughly 60 p.ct. from the vertical. At each end it was "washed" up by an easy slope to the corner baffles. Between it and the oven side was left a slot through which the products of combustion made their way from the flames into the oven itself. The whole base with horizontal corner baffles and curtains was cast in one piece.

The inclination of the curtain made access to the burner for removal easy, while the curtain itself prevented downwardly moving products from affecting the centre flame. Several bases embodying these ideas, and differing only in small details, were cast and made up into complete ovens. Our tests on these showed that our reasoning had been well-founded, for we immediately obtained improved S test figures in the neighbourhood of 60 c.ft. and over, and figures of merit well under 400 B.Th.U. per sq. ft. per hour.

These ovens, lettered from E to J, were then subjected to a large number of minor alterations to ascertain exactly their best form for satisfying all the conditions already enumerated. As before, at every alteration S and M tests were carried out, and in many instances the results were confirmed by repetition. In this way we settled the width and length of the slot through which the products of combustion enter the oven proper, its distance from the side wall, the depth of the curtain, and so on.

Auxiliary Flue Outlets.

During these tests it was observed that in some of the bases which had been put up to very high consumptions without smothering, there was a line internally above which the iron had rusted from condensed water, and below which it had retained its foundry surface. This gave us the idea of auxiliary flue outlets below the level of the base top. In our first experiments such outlets were tried above the base top, during what I have called the "cure" experiments. At that stage they improved the factor of safety, but hopelessly compromised the figure of merit, and were abandoned. With the satisfactory completion of the "prevention" experiments, and the above observation with regard to rust, we went into the matter again. We found that, by locating and dimensioning such outlets correctly, we could improve the factor of safety to such an extent that when the main flue outlet was entirely blocked up the oven would continue to burn 40 c.ft. of gas without smothering, and yet the figure of merit was unaffected under ordinary conditions. Actually these outlets do not come into operation until well above the normal maximum consumption; and by themselves, with the main flue out of commission, they are capable of giving the oven a factor of safety of about 100 p.ct.

To bring this particular part of the subject to a close, I may say that all "Conservor" ovens are now supplied with the new base embodying the details described in the foregoing part of this paper. They have vertical flames protected by a combination of horizontal baffles and curtains, and they have auxiliary flue outlets. Their figure of merit under strictly comparable conditions is considerably better than any oven I have been able to acquire and test. So far as smothering goes, they are foolproof, with a factor of safety of between 200 and 300 p.ct., and, further, a factor of about 100 p.ct. when the main flue is closed. Interchangeability is practically unimpaired, since from the base upwards there has been no alteration, and the new base takes the same body as before.

The convenience to the user is what it was, and cooking capabilities are improved. To make certain, in addition to the bread

baking tests already described, various other foodstuffs were cooked, including some 700 small scones; the tests being made against the best competitive ovens obtainable. Altogether, you will recognize that we consider that this intensive oven research has resulted in a notable advance in the appliance now offered to the gas industry and the public.

SINGLE-BURNER AND TWO-BURNER OVENS.

The concluding matters that I wish to touch on were undertaken as subsidiary to the main object of the research. They are, however, of general interest. As you are all aware, there has been during the last few years a considerable effort made to popularize ovens with single burners. I should like to make it clear that we have no prejudice against single-burner ovens as such, for we ourselves make and supply thousands of such ovens in the course of a year. We do this for the purpose of reducing the price, which in this instance must be as low as possible. When, however, a high-grade cooker is in consideration, the matter must be looked at from another angle—viz., that of performance—and while we were going so closely into the improvement of our ovens, we did not overlook the possibilities of an oven with one burner. In order to give the matter full consideration, we not only made such ovens of our own, but we obtained the best single-burner ovens of other makes for comparison. Before going on to describe the results obtained in practice, let us try without prejudice to consider what might be expected from this form of oven.

Unless the single burner be centrally disposed (which disposition has not been as yet put forward in this country, though I believe some American ovens are thus heated), it seems clear that one wall of the oven—that nearest the burner—will be hotter than the opposite one; and if this is so, there will be a tendency towards uneven cooking. Further, as all the gas required for the heating is concentrated along one wall, a considerable space will have to be left free for the ascension of the products of combustion up that wall; otherwise foodstuffs will be overcooked or even burned should they project into the rising stream. Then there is the matter of equality of temperature as between top and bottom of the oven. You have seen the figures for the two-burner "Conservor" oven; and the temperature distribution is remarkable for its evenness.

If a burner is made to light-back, why does it do so? The answer to this question is, of course, that the velocity of the mixture of gas and primary air issuing from the burner orifices has been less than that of the velocity of burning of the mixture. This latter backward velocity has overcome the forward velocity of the mixture, and lighting-back to the injector nipple has followed. So long as the forward velocity of the mixture is greater than the backward velocity of the flame, lighting-back will not occur. The forward velocity depends on the volume of mixture and the area of the teat orifices. If you consider any one oven, it will be apparent that, whatever the number of burners used, the gas required to do any particular cooking operation will be the same; and if your burner or burners are correctly designed, the total teat area will be the same. Thus, if you require twenty teats of a given size on a single burner, you will require ten similar teats on each of two burners, and the forward velocity of your mixture through them remains the same. Actually, I find that by-pass consumptions on thermostats now obtainable by purchase, including our own "Mainstat," are all about the same—viz., about 4 to 5 c.ft. of gas per hour at (say) 20-tenths pressure. I have made a number of experiments with these to ascertain under what conditions the burners light back or go out. The basis of the experiment is the sudden cutting-down of a medium or high consumption to a predetermined very low by-pass consumption. In these circumstances (which could occur in practice if the thermostat were suddenly reduced from a high to a low "mark") the momentum of the gas and air mixture passing along the "mixing tube" of the burner at the instant of cutting-down is sufficient to draw in an excess of air over and above that required for the correct aeration of the reduced rate of gas. If the excess is very great, the flames are extinguished, because the mixture is momentarily incombustible; if the excess is not so great, lighting-back may occur, because the mixture is momentarily highly aerated and consequently has a high velocity of "back-fire." The danger of one or the other happening only lasts for the very short period during which the momentum endures in the mixing tube. Thereafter the small by-pass rate at a low velocity establishes its own mixture at a small momentum, and the flames become stable again.

Tested in this way and using a single-burner oven as designed by its makers against our own two-burner oven, we actually found the latter better than the former, as the figures at the top of the next column show.

The result is even more favourable to the two burner oven than appears, because the teat area of the single burner happened to be about one-quarter less than the total teat area of the two burners. I am inclined to attribute the superiority of the two burners to the fact that the single burner necessarily has longer and larger passages, and that therefore the momentum of the mixture at the instant of cutting-down is greater, and hence there is formed, momentarily, a more explosive mixture. Whatever the reason, the figures show very conclusively that the burners are safer than a single burner when a thermostat is used.

By-Pass Rate.	Consumption Below which Lighting-Back Occurs at—			
Single Burner.	20-Tenths.	30-Tenths.	40-Tenths.	50-Tenths.
6 c.ft. per hour . .	10	13	24	23
5 ,, ,, . .	10	14	30	25
4 ,, ,, . .	11	18	26	33
3 ,, ,, . .	15	18	22	26
Two Burner.				
6 c.ft. per hour . .	6	7½	11½	15
5 ,, ,, . .	6	7½	12	15
4 ,, ,, . .	6	8½	13	14
3 ,, ,, . .	6	9½	12½	16

Before leaving the thermostat question, I must allude to an argument based on the by-pass consumption. It is to the effect that a single burner with a thermostat will give the same temperature at a given setting of the indicating head whatever the pressure and calorific value of the gas used with it. It is, of course, true that when pressure and calorific value alter, the larger the by-pass consumption, the more the temperature will diverge from that designed to correspond to a given setting. This is because the by-pass consumption is uncontrolled by the thermostat, and therefore more or fewer B.Th.U. are passed to, and developed at, the burner. As two burners have been shown to work equally well with as low a by-pass consumption as a single burner, the argument is without meaning. Quite apart from the by-pass, however, no commercial thermostat of the type under discussion can be expected to give the same temperature at the same setting if the pressure and quality of supply are altered, for at any temperature there is a definite distance between the valve and its seating, and therefore the delivery through the valve orifice of a definite number of B.Th.U. per hour. If the pressure or calorific value rise, for instance, more B.Th.U. will pass, and a higher temperature will be caused. The valve orifice will then close somewhat; but obviously the oven cannot return to the same exact temperature, because the orifice is a function of the temperature, and the original orifice corresponding to the original temperature was too great at the increased pressure and calorific value. The thermostat will attempt to re-establish the original temperature by closing slightly; but it will never succeed exactly in its attempt. If pressure and calorific value are sufficiently higher at any particular consumer's than those at which the thermostat was originally tested, an allowance of a mark or two lower than given on the chart may have to be made to ensure the correct conditions in the oven. This is not a serious matter, for the alteration can be determined during the first few cooking operations, and noted for future reference.

I mentioned earlier in this paper that there are differences between modern ovens in their behaviour under the heating-up test. In this test the temperature attained at the central point of the oven is taken as the criterion. If temperatures be taken simultaneously at various other positions, it is found that during heating up this one single temperature gives a considerable fictitious advantage to a single-burner oven over a two-burner oven. The point is best brought out by giving some typical figures—viz.:

Bottom-Flued Ovens.

[Heating-Up in Various Times to Approx. 400° Fahr.]

Mins.	B^b_2.	C^b_2.	D^b_2.	(C^a_2).	Mean.	Difference from C^b_2.
Single-burner—						
14	421	396	275	..	263	33
9	430	403	279	..	370	33
7	415	388	266	..	356	32
6	433	401	271	385	369	32
Two-burner—						
15	410	394	347	..	383	11
8	424	388	333	..	387	7
7	433	394	344	..	390	4
6	417	388	351	509	383	3
5	428	392	356	532	392	*Nil*

The point is, of course, that the test was originally put forward for two-burner ovens; and, as the figures show, the centre position C^b_2 fairly represents the mean of readings taken simultaneously at the centre of each third of the oven, whereas with a single-burner oven the one central reading C^b_2 is considerably higher than the mean of the thirds. There is evidence that, if it were possible to take all 27 readings, as in a maintenance test, simultaneously during heating up, in two-burner ovens the central position C^b_2 would be definitely lower than the mean of all, while in single-burner ovens C^b_2 would flatter the oven still more than it does above. This is partly shown by the side reading C^b_2 given in one or two instances.

Uneven Distribution of Temperature in Single-Burner Ovens (Sides).

Position and Number of Thermometers.	Oven A with				Oven E with				Other Single-Burner Ovens.					
	Two Burners.		One Burner.		Two Burners.		One Burner.		X.		Y.		Z.	
			Near.	Far.			Near.	Far.	Near.	Far.	Near.	Far.	Near.	Far.
Top (3)	448	444	478	444	448	439	459	438	483	453	457	438	482	438
Middle (3)	455	460	482	428	455	451	468	415	459	435	431	412	497	418
Bottom (3)	457	432	417	375	403	430	375	354	428	408	342	325	487	368
Mean (9)	453	445	459	416	435	440	434	402	457	432	410	392	488	408
Difference	8		43		5		32		25		18		80	

These, with others not quoted, usually showed 110° Fahr. higher than the centre reading in two-burner ovens, and some 20° Fahr. lower than the centre in single-burner ovens.

Returning to our experimental work with single and two burner ovens, we re-designed some of the experimental ovens already mentioned, and also used single-burner ovens procurable by purchase. We first looked into the question of temperatures as between the opposite sides of the oven. According to the previous reasoning we should expect the side nearest the burner to be hotter than the side remote from it. The above figures show this to be the case.

The greater the difference, the more likely there will be uneven cooking from side to side; and this is particularly noticeable where heavy loads are cooked.

The next set of figures refers to the same ovens, and shows the difference between the top, middle, and bottom zones, B, C, and D—viz.:

Uneven Distribution of Temperature in Single Burner Ovens (Top and Bottom).

Position and Number of Thermometers.	Oven A. Burners—		Oven E. Burners—		Other Single-Burner Ovens.		
	Two.	One.	Two.	One.	X.	Y.	Z.
A (1)	446	468	437	466	448	437	437
B (9)	445	459	443	445	440	443	451
C (9)	452	447	444	434	420	418	439
D (9)	432	390	410	365	373	333	404
Mean (27)	443	431	432	415	411	398	431
A – D	14	78	27	101	75	104	33

The single burner ovens therefore fall away in temperature not only from side to side, but also from top to bottom; and so far as the figures go, it would appear that those more equal from side to side are less equal from top to bottom, and *vice versa*.

Inequality of temperature as between top and bottom, which is clearly a characteristic of single-burner ovens, is now claimed as a virtue because it is said that foodstuffs requiring widely different temperatures can be cooked at one and the same time. This virtue, however, is also possessed by the usual two-burner oven with top-flue.

So far as performance goes, the inequality is a disadvantage for heavy loads. Bread is more evenly cooked with two burners than with one, and, so far as bottom-flued ovens go, with about 20 p.ct. less gas for the work. It is also clear that the more even the oven, the more satisfactory thermostatic control is likely to be, because the thermostat can only work at one place in the oven, and is controlled by the temperature obtaining there. It is for this reason that bottom-flued ovens generally are more suited for use with thermostats than are top-flued ovens; and, as the figures show, two burners score heavily in this respect.

All this work then has convinced us that there is no outstanding virtue in using a single burner. In fact, now that we have overcome the constitutional tendency of highly efficient ovens towards smothering, by the means I have already described to you, we can go further and say that two burners give the better all-round service, and that, just as they have prevailed in top-flued ovens for over fifty years, there seems to be no reason why they should not still be the rule fifty years hence.

Discussion.

The PRESIDENT, after congratulating the author upon his address, said that as far as he could find out the idea of cooking by gas was conceived by a man named Goddard, of Ipswich, many years ago, who arranged the heating of an ordinary sheet-iron box by jets placed inside it. The apparatus was not insulated in any way. From this idea had sprung the cast-iron cooker, followed by cookers having top flue outlets, and later, bottom flue outlets with one or two burners, and now Mr. Forshaw had given them a record of his careful tests, which showed the large amount of experimental work which had to be carried out before a modern up-to-date cooker could be placed on the market. The Association were very grateful to him for his contribution to the proceedings. In a recent article in the Technical Press, he had noticed that they were very keen on this particular subject in Germany. Mr. Forshaw appeared to have concentrated on the factor of safety and the figure of merit. Roughly speaking, there was a heat saving of 25 p.ct. compared with the old type of cooker with a top flue outlet. He thought that the bottom flue outlet cooker had come to stay. There was, in his opinion, a considerable amount still to do in educating both the public who used the cookers and the men who fixed them. He found that many people did not understand the working of the thermostat. He was not convinced that a thermostat which would stand the test of years had yet been devised. From his experience he had found that the present type became gummed-up after being in use a year or two.

A vote of thanks was then proposed by Mr. W. MCNAUGHTON (Wolverhampton).

Mr. G. M. LEWIS (Showroom Manager, Birmingham Gas Department), in seconding the vote, congratulated Mr. Forshaw on the amount of work he had put into the tests. In Birmingham they had had an opportunity of investigating cookers with bottom flue outlet, and he was not sure that this type had come to stay. He wondered if the author had considered in his tests the operation of a top flue outlet with a mechanically controlled aperture. They had experienced many complaints in regard to cookers with bottom flue outlet, in particular regarding the steaming round the joints of the oven, the rusting of the dome of the oven, and dust, &c., falling on to the food. He thought a lot of trouble was due to the condensation in the oven, which was not carried away so quickly as was the case with an oven with a top flue. He asked what was the purpose of the solid tray which was now being supplied with the "Conservor" oven. He thought it was a fact that one could not cook (say) a joint and a rice pudding at the same time as satisfactorily in an oven with a bottom flue as could be done in one having a top flue. He was also of the opinion that in the modern type of cooker the oven space was not sufficiently large, and consequently a joint could not be hung from the roof, which, in his opinion, was the correct method of roasting.

Mr. G. E. BURDEN (Redditch) said it gave him much pleasure to associate himself with the vote of thanks to the author. He testified to the valuable assistance which the technical departments of apparatus manufacturers gave to the industry. He asked whether, if it were possible to get a perfectly even temperature in the oven, it would be preferable to the slight variations in temperature shown by the tests.

Mr. FORSHAW, after thanking the members for the way in which they had received the paper, in reply to Mr. Lewis, said that he took it the latter was alluding to the National Gas Council's type of oven. He believed that this oven cooked quite well, but, though the arrangement of a flue damper synchronized in its movements with the gas cock was an improvement from the point of view of efficiency, because it prevented a considerable quantity of air from being drawn through the oven at low consumptions, yet it could not do this effectively at widely varying gas pressures and calorific values, and a considerable margin of opening had to be left to allow for these differences. The bottom flued oven, on the other hand, provided an automatic means of preventing this waste due to unnecessary extra air.

As to steaming, all efficient ovens condensed the steam from the products of combustion during the first few minutes after lighting up from cold. In bad cases the actual running-down of condensed water might be cured, or at least greatly minimized, by leaving the door ajar for a short time until the internal linings of the oven were warm, after which condensation would not occur. The small tray alluded to was to support small cakes and the like, which would otherwise tend to fall through the grid shelves.

If it were required to cook a joint and a rice pudding at the same time in a bottom flued oven, the former would have to be done in a tin, and the pudding below it on the lowest shelf. It might be necessary to cover the pudding with a meat plate until it was ready for browning. Actually a rice pudding required a much longer time for cooking properly than did the ordinary joint; and he suggested that those who regularly had such puddings would find that, after the dinner had been removed from the oven, a new pudding could be put in, and the rice effectively swelled by means of the residual heat. This, of course, applied only to a bottom-flued oven, which retained its heat for a long time because there was no through-draught. The following day the pudding was finished off with that day's dinner. He did not claim this procedure as his own. It was given him by a gas engineer who practised it with great success. He applauded the opinion that meat should be hung or cooked on a grid shelf. In reply to Mr. Burden, Mr. Forshaw said that evenness of temperature generally showed high efficiency, and that by suitable manipulation a dinner including vegetables could be cooked in an evenly heated oven.

Other points dealt with were connected with thermostats, and Mr. Forshaw said he had not come across a case of a "Mainstat" gumming up. In this, a metal-to-metal ground joint was used. This was very effective, and could not fail.

WALES AND MONMOUTHSHIRE JUNIOR GAS ASSOCIATION.

Elimination of Tar Fog.

The Fifth General Meeting of the session was held at the Gas Offices, Bute Terrace, Cardiff, on Feb. 16; the chair being occupied by Mr. W. E. Crowley (Senior Vice-President) in place of Mr. C. B. Felton (President), who was unavoidably absent owing to illness.

The Hon. Secretary read a communication received from H.M. The Queen in acknowledgment of a resolution of sympathy conveyed to her on behalf of the members of the Association, regarding the protracted illness of His Majesty.

Apologies for absence from the meeting had been received from Mr. J. H. Canning (Newport), Mr. I. F. Rust (Newport), and Mr. S. E. Brett (Rhondda). Mr. R. P. Brown (Cardiff) was elected an Associate Member.

MANUFACTURE AND CONDENSATION OF CARBURETTED WATER GAS.

By TERENCE H. MADDEN, of Cardiff.

The author first described the chemical reactions and gave test figures for two 2-million Humphreys & Glasgow C.W.G. sets with waste-heat boilers at the Grangetown Works of the Cardiff Company. These sets have been erected on a new site; the three older 1-million sets being held in reserve. With the new sets, an average day shows the following results:

Coke used	33 tons
Breeze returned	3 ,,
Gas made	1,631,000 c.ft.
Gas per ton generator coke	49,424 ,,
Oil used, at 12 galls. per run	2,323 galls.
Oil per 1000 c.ft.	1·42 galls.

Mr. Madden then proceeded to deal with the subject of condensation.

CONDENSATION.

The stream of gas on leaving the plant has had 40 to 50 p.ct. of the condensable matter removed by the washer. The gas passes from the plant to the condensers through a 24-in. C.I. pipe over a distance of 60 yards. I might add that this length of connecting main acts also as another condensing factor. The condensers are of the Beckton design of Graham type fitted with water sprays, with the inlet at the top and the outlet at the bottom; and the drop in temperature between the plant and the outlet of the coolers is from 125° to 120° Fahr. Tar offtakes are connected to the condensers and sealed in syphons, which allows the deposited tar to run over into a well. The tar and water are drawn away from the well through a 3-in. C.I. pipe with the aid of a suction pump, which eventually delivers into a separator tank.

The gas then passes over a distance of 150 yards from the coolers to the relief holder, and is further reduced in temperature. Several syphons are connected to the main, and are pumped every two hours into the well of the relief holder, where the oil gas tar separates from the water and is removed. The suction pump provided for this purpose is capable of removing the condensates at various syphons up to the oxide purifiers. The gas is drawn from the holder by exhausters, and passes through the original cyclone tar extractors, to which recently has been added a new separator for the removal of the last traces of tar fog and naphthalene.

You are all aware, I think, of the controversy existing between the sulphuric acid manufacturers and the gas undertakings, concerning the comparatively large proportion of oily tar found in spent oxide from C.W.G. purifiers. It was for this reason that we installed an additional apparatus between the exhausters and the purifiers to work in conjunction with the existing cyclone tar fog extractors. The apparatus is original in its working, and you may find my report and description of interest.

TANGENTIAL "CASCADE" TAR FOG SEPARATOR.

The new separator is a cast-iron cylindrical apparatus, 7 ft. 6 in. in height and 6 ft. in diameter. It is divided into two distinct departments—the solvent tank and the brush and steel wool chambers. The first compartment acts as a storage well for the oil which is circulated throughout the apparatus when necessary, and the second is the part in which the gas passes.

Gas, on leaving the cyclone, passes into the separator through a 24-in. to 15-in. reducing piece, and immediately makes its way in an upward and downward motion through the baffle plate and into the brush chamber. The brushes are made of steel wire, and are connected to a centre spindle, which may be moved by a hand-wheel in either direction. These brushes offer a ready surface to the gas for the removal of tar fog, and the speed of the gas through the separator is regulated by them. This is accomplished by the manipulation of the hand-wheel, increasing or decreasing the gas-way by the position of the brushes. The gas, on leaving the brush chamber, passes up through a layer of steel wool, 6 in. in height and supported by a tray, which removes a large proportion of the oily matter and tar. The steel wool is covered by a perforated disc, the holes of which are ⅛ in. in diameter, through which the gas passes before leaving the apparatus.

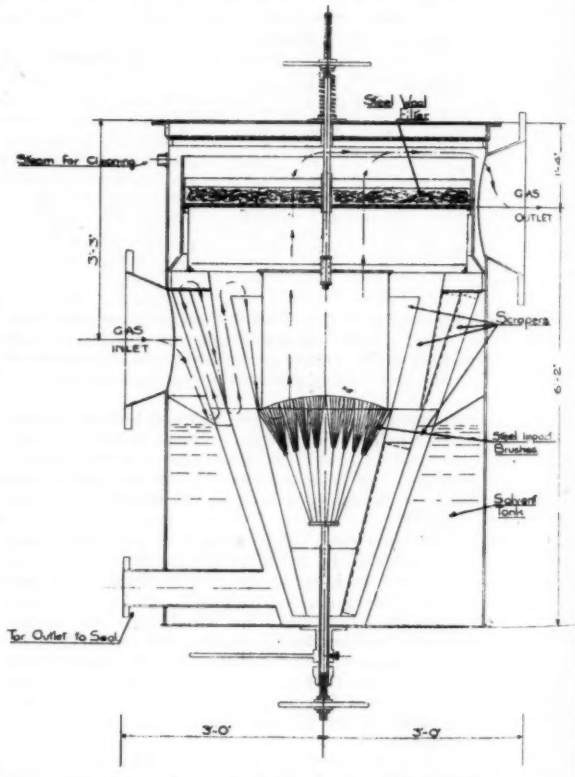
The maximum hourly flow through the separator is 150,000 c.ft., giving a daily capacity of 3,600,000 c.ft., and the pressure drop is 3 in. W.G. When the separator was erected and brought into action, a series of tests was taken to ascertain the efficiency of the plant, and the results obtained were:

	Moisture Removed. P.Ct.	Tar Removed. P.Ct.
Cyclones	16	10
Separator	12	58

The total of the above is 96 p.ct., only 4 p.ct. of the condensates being carried forward by the gas into the purifiers. The seal-pot deposits contained 41 p.ct. of water; and the seal-pot oil gave distillation figures as follows:

170°–300° C.	80 p.ct.
Residue	soft pitch
Naphthalene	10 grains per 100 c.ft.

The effect on the purifying material attached to this stream is noticeable, inasmuch as after the separator had been in use



Tangential Patent "Cascade" Tar-Fog Separator.

for some time it was found, on opening the purifying boxes, that very little naphthalene had gone forward. Previously we experienced 1 in. to 2 in. of naphthalene deposit coated over the surface of the oxide and on the inside of the purifier cover. Afterwards arrangements were made to circulate oil through various sections of the separator in order to remove to the seal-pot the tar deposits in the steel wool filter and other chambers. During this operation, it was observed that a large proportion of tar was brought down, notwithstanding the fact that the gas had previously passed through the original cyclone extractors. The oil circulation is as follows: (1) From solvent tank into steel wool filter. (2) From solvent tank into scrapers. (3) From brush chamber into solvent tank.

It was noticed, after the separator had been in use for some weeks, that the pressure drop was 5/6 in. W.G.; and as this was causing undue vibration to the cyclone, we were compelled to by-pass a small proportion of the gas from the cyclone into the 24-in. main. After over two months, it was found desirable to open-up the separator; and it was noticed that the

steel wool was completely clogged up with tar and oil and naphthalene, and needed renewing—this fact, no doubt, fully explaining the efficiency of the apparatus. In actual practice, the maximum back pressure should be approximately 3 in. W.G. under general working conditions.

WASTE-HEAT BOILERS.

Each of the two waste-heat boilers is capable of evaporating 350 gallons of water per hour. The boilers are by Messrs. Ruston & Hornsby, and each has 202 3-in. tubes 18 in. in length, with a heating surface of 2871 sq. ft. The hot waste gases of the "blow" enter the boiler at a temperature of 1100° C., and leave at an average temperature of 224° C.; the maximum being 300° C. and the minimum 160° C. During a blow, the pressure of the boiler should have increased 5 lbs., and the pressure gauge attached to the boiler should register at least 60 lbs.; the safety valve blowing off at 75 lbs.

In obtaining the tubular efficiency of one of our waste-heat boilers, the following formula was used:

$$\frac{\text{Inlet temperature of gases} - \text{outlet ditto}}{\text{Inlet ditto} - \text{temperature of water in boiler}} \times 100.$$

Thence we obtained:

$$\frac{1100° - 224° \text{ C.}}{1100° - 151° \text{ C.}} = \frac{876}{949} \times 100 = 91{\cdot}1 \text{ p.ct.}$$

In the usual way, the boiler will evaporate 7000 to 8000 gallons of water per day, thereby providing 70,000 to 80,000 lbs. of steam, which is more than sufficient for the gasification process. The steam main is connected to that from the adjacent sulphate plant boilers; and they act as balancers and receivers when the waste-heat boilers are steaming heavily. This further supply of steam is utilized for assisting in the driving of the turbines, oil pumps, &c. Actually the waste-heat boilers account for 52 p.ct. of the total steam consumption of the plant. On the latest C.W.G. plant, the generator is encircled by a water jacket, and the supply of steam is sufficient to cope with the demands of the whole plant, including turbines, pumps, &c.

The heat from the waste steam from the turbines is now being reclaimed by us for the preheating of the feed-water, normally at a temperature of 50° Fahr., before passing direct into the boiler. This is accomplished by passing the feed-water from the storage tank on the operating floor down to an exhaust steam preheater. Unfortunately, I am unable to give the rise in temperature of the water, as the apparatus is not in full working order. However, I shall be pleased to supply the necessary data upon your inquiry in the future. Meanwhile we estimate that the feed water will enter the boiler at a temperature of at least 180° Fahr.

Discussion.

Mr. W. E. CROWLEY (Newport) opened the discussion by complimenting Mr. Madden on his efforts in preparing such an interesting paper. It was very gratifying to note that the Associate Members were coming forward with their contributions; it augured well for the future of the Association.

Mr. KELVIN JONES (Newport) said he had listened to the paper with the greatest pleasure. He went on to ask a question with regard to the percentage of moisture content removed by the cyclones and separator.

Mr. C. S. THANE (Newport) asked if there would not be a sudden rush of steam from the outside boiler into the waste-heat boiler during operations.

Mr. B. J. BELL (Cardiff) said he did not wish to offer any criticism on the paper—sufficient to congratulate the reader on his first effort, which he hoped would be followed by many more. He (Mr. Bell) had been connected with Junior Associations for the past 20 years, and had watched the career of young members, some who to-day were holding responsible positions in the gas industry. He wished Mr. Madden every success in the future.

Mr. H. S. BARTLETT (Cardiff) asked what was the percentage of C.W.G. in the whole of the gas made on the works. He wished to be associated with the other speakers in thanking Mr. Madden for his excellent paper.

Mr. T. LANE (Cardiff), referring to the installation of the cascade washer, said it was interesting to note it had been the means of eliminating the naphthalene deposits in the carburetted gas purifiers.

Mr. T. H. MADDEN, having thanked all the members who had spoken, proceeded to deal with the various points raised. Referring to the moisture content removed by the cyclones and separator, it was found by a system of testing on the plant at the inlet and outlet that the percentage removed was 12 to 15 p.ct. As to the possibility of a sudden rush of steam from the outside boiler, he would say that the drop in pressure in the waste-heat boiler during the run would not exceed 5 lbs., so that no such effect was noticeable. The C.W.G. made would be 20 to 30 p.ct.

PARLIAMENTARY INTELLIGENCE.

[From Our Special Correspondents.]

HOUSE OF LORDS.

Gas Undertakings Bill.

There is no further actual progress to report on the Gas Undertakings Bill, as the Committee stage, which was originally put down for March 5, was postponed first to March 7, and then again to March 12. But a number of amendments have been put down to the Bill. Lord Banbury of Southam, who had expressed his objections on the Second Reading, is moving to delete the clause which permits the Board of Trade to make an Order increasing the amount of share capital or of loans. Alternatively, he is moving that any mortgage or debenture stock so created shall rank after any existing stock. He also proposes to delete clause 6, which extends the Board of Trade's powers to make Special Orders.

Viscount Bertie of Thame is moving the deletion of section 4 of the clause, which bases charges upon thermal units. This section repeals existing Special Acts or Orders with respect to quality, pressure, or purity of gas. Viscount Falmouth has put down a motion to delete the power given to the Board of Trade to insert provisions in Special Orders corresponding to those already contained in other Special Acts or Orders. There are in addition a number of other amendments put down by the Earl of Lucan on behalf of the Government, most of which are of a drafting character. One of them, however, is rather more important, as it is a revision of the schedule of minor amendments in the following terms:

Schedule, p. 7, line 6, leave out from "following" to the end of line 22, and insert:

> "If at any time it appears to the Board of Trade, in relation to any undertakers, that there has since June 13, 1914, been any increase or decrease in—
>
> (*a*) the rate of interest which the undertakers are obliged to pay on capital raised or money borrowed for the purposes of their gas undertaking; or
>
> (*b*) the cost to the undertakers of providing works, plant, or apparatus for the supply of gas; or
>
> (*c*) the annual output of their gas undertaking; or
>
> (*d*) the efficiency with which that undertaking has been carried on;
>
> the Board may make an amending Order under this section revising the powers of charging authorized by the original Order with respect to the undertakers, in such manner as to secure that they are not prejudiced by any such increase or benefited by any such decrease."

SOUTH SUBURBAN GAS BILL.

On Wednesday, March 6, the Unopposed Committee of the House of Commons sent the South Suburban Gas Company's Bill forward for third reading.

Mr. SEAGAR BERRY (Messrs. Sherwood & Co., Parliamentary Agents) said that the only object of the Bill was to acquire the undertaking of the Northfleet and Greenhithe Gas Company on terms set out in the Schedule to the Bill (particulars were given in the "JOURNAL" for Jan. 23, p. 210). Continuing, Mr. Berry explained that the gas limits of the South Suburban Company would be increased to take in the area of the Northfleet Company.

The CHAIRMAN (the Deputy-Chairman of Ways and Means) asked if it were the case that the South Suburban Company were closely linked with the South Metropolitan Gas Company.

Mr. BERRY replied that there were working arrangements between the two Companies, and he believed the Directors of the Boards were the same, or that some Directors of the one Company were also Directors of the other. Continuing, he said that the Northfleet Company was originally formed in 1877 by the incorporation of the Greenhithe Gas Company. In 1881 the Northfleet Gas Company was formed, and the two concerns were amalgamated. The undertaking to-day was a small one, having an annual output of 50 million c.ft. of gas, compared with the 4000 million c.ft. output of the South Suburban Company. The price in the area of the Northfleet Company to-day was 1s. 4d. per therm, whereas the South Suburban price was 9d. per therm. The first result of the purchase of the Northfleet Company by the South Suburban Company would be an immediate reduction of 4d. per therm, which was equivalent to 1s. 8d. per 1000 c.ft., while the remaining differential of 3d. per therm would be reduced gradually over a period until it disappeared. It was not at first proposed to do this, but by agreement with the Northfleet Council an additional provision to that effect had been added to the Bill. Eventually, therefore, the price of gas in the Northfleet area would be the same as that in the other area of the South Suburban Company. No new capital or other powers were asked for in the Bill.

The CHAIRMAN asked if the local gas-works would be put out of action as a result of the purchase of the Company.

Mr. BERRY said that probably in time the Northfleet gas-works would be put out of action, and the area supplied from the larger works of the South Suburban Company.

Mr. WILFRID WASTELL (Commercial Manager and Secretary to the South Suburban Gas Company) formally proved the preamble of the Bill.

MISCELLANEOUS NEWS.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

Quarterly or Monthly Accounts?

The Ordinary General Meeting of the Company was held at 5, Great Winchester Street, Old Broad Street, E.C., last Friday—Mr. A. M. Paddon, M.Inst.C.E. (the Chairman), presiding.

The Secretary (Mr. Hyde C. Burton, A.C.A.) read the notice convening the meeting; and the report of the Directors and statement of accounts for the year ended Dec. 31 were taken as read.

The Chairman, in moving the adoption of the report and accounts, said it was with deep regret that they announced the resignation from the Board of Mr. John Miles, on account of ill-health. To fill the vacancy they had elected Mr. William Cash, who already possessed a great knowledge of the working of the undertaking. During the year the increase in the sale of gas had amounted only to a little over 1 p.ct.; but it had been a period of great activity by reason of the continued development of the works, and the organization of their business in the rather exceptional circumstances peculiar to that undertaking. With regard to the capital account, there had been expended during the year over £25,000 upon plant, buildings, and meters, and there had been written-off from this item over £11,500, leaving the capital employed in the undertaking, as actually expended, at the low figure of £425 per million c.ft. sold. It was gratifying to think that, although they had constructed their works at Portslade almost *de novo*, and had reconstructed the distribution system so as to afford no sort of comparison with what it was before the war, the capital had fallen by over 20 p.ct. from what it was in pre-war days. When they remembered the cost of materials in recent years, it was all the more remarkable that the capital should have shown this reduction. There had been received, by reason of the reduction in the price of gas, some £23,000 less from this source; while residuals showed a falling off of something like 20 p.ct. The outcome of the revenue account was that the receipts were £52,000 less, and the expenditure was over £40,000 less, the profit showing a decrease of £10,000. The amount brought into the profit and loss account was £64,261, and they were taking out of it £77,417, thus showing an improvement in the relative position by some £13,000. The total amount standing to the credit of co-partnership was over £50,000. He could only say that the co-partnership movement was a conspicuous success. In the early part of the current year, in common with all undertakings, they had had to pass through a severe ordeal, in which the duties of the employees were greatly in excess of what could have been reasonably expected of them, but they had responded in a most loyal way. In fact, the relations with their employees, by reason of this co-partnership, were practically everything that could be wished. As to the business, he thought the pro-pects in Brighton were good.

Methods of Charge.

With regard to the recent abnormally cold weather, the large demands for gas which had resulted on the part of the public were both difficult and expensive to meet; but there was even greater disability involved, and that was in connection with their method of charge. The industry continued to charge for gas in exactly the same way as it did sixty or seventy years ago. In those days, credit was given in every direction, whereas to-day nearly all the essential commodities in London were purchased on a cash basis. All the trade went to the ready-money business, but the gas companies had persisted in their old practice.

Proceeding, the Chairman said: What has happened is this. The standard of competence, as I may call it, of the gas consumer has been steadily falling. A long time ago the gas companies had to deal with an affluent class; but our consumers have been becoming poorer and poorer every year, until, finally, our business rests on the very poor people to whom gas is a necessity and not a luxury, and if you are to trade successfully you will have to carry the principle of cash for goods even a little farther, and get the cash before the goods are actually delivered. That is what the prepayment system means. Pay for the article before you get it, and thus give more vitality to that portion of our business than to any other. When the practicability of the idea was first introduced, we thought, when a man put in a penny before gas was consumed, we should get only a small amount. We thought if we could sell 14,000 c.ft. per consumer we should be lucky. The figure has risen from 14,000 to 30,000 c.ft.—that is the rate of progress of the South Metropolitan Company—and here to-day we ourselves sell nearly 27,000 c.ft. per consumer per annum to prepayment consumers. The fact is that the consumer gets what he pays for, and pays for it as he gets it.

When you come to the quarterly consumer, the payment is deferred until the end of the quarter. In January, when the weather is cold, he begins to burn the gas; and it is not until the skies are clearer and the weather is warmer, and all the circumstances for which gas gave him relief are past and forgotten, that he gets his bill, as he gets his demands from the King's tax collector. We, the gas companies, are included in the same unpopular category. [Laughter.] The gas consumer forgets what the gas has done for him in the way of comfort, and he is disturbed by what he has to pay. But what really frightens him and frightens his wife is that a figure comes into his household budget for a commodity to which they are not accustomed. When the quarterly accounts are rendered, our officials are promptly asked to take back the apparatus—apparatus which costs the Company a great deal to put out, and which at the end of the winter we are requested to take away. That is not economical. We do not have this trouble with the prepayment consumers, or when a man is allowed to pay for his goods as he receives them.

Mr. Paddon concluded by remarking that the time had come for the gas companies to put their house in order in this respect. The second largest gas company had done so already, and with unqualified success. There had not been any increase in the cost of collection, and the new system had been received by the consumers with great satisfaction. It must lead to a vast increase in the use of gas by those who would be perturbed by the receipt of a large quarterly account.

The Deputy-Chairman (Mr. G. W. Carey) seconded the resolution for the adoption of the report and accounts, and it was unanimously agreed to.

Dividends were declared making in the case of the 6 p.ct. and 5 p.ct. standard consolidated stocks a distribution of £7 10s. p.ct. and £6 15s. p.ct. respectively, less income-tax.

The retiring Directors (Mr. A. M. Paddon and Sir Charles L. Morgan, C.B.E., M.Inst.C.E.) and the Auditors (Mr. W. B. Paton, A.C.A., and Lt.-Col. Wilfrid C. Smith, D.S.O., M.C., F.C.A.) were re-elected.

The Chairman proposed a vote of thanks to the officers and employees of the Company for their contribution to the successful statement which had been placed before the shareholders that day, and also for their efforts during the last two difficult months. Not one had failed them in any single regard.

Mr. Mason seconded the vote, which was heartily passed, and acknowledged by Mr. C. H. Rutter, M.Inst.C.E., Engineer and General Manager.

The proceedings concluded with a vote of thanks to the Chairman and Directors.

LEA BRIDGE DISTRICT GAS COMPANY.

Annual General Meeting.

The Ordinary Annual Meeting of the Company was held on Tuesday, March 5, at the Company's offices, 63 and 64, Chancery Lane, London, W.C. 2, Mr. A. M. Paddon, M.Inst.C.E. (the Chairman), presiding.

The notice convening the meeting was read by Mr. Henry Hand, the Secretary, and the seal was affixed to the Registrar of Proprietors. The report of the Directors and the statement of accounts for the year ended Dec. 31, 1928, were taken as read.

The Chairman, proposing the adoption of the report and accounts, first expressed the deep regret of the Directors—which he felt sure was shared by the proprietors generally—at the retirement of Mr. John Marshall Miles from the Board of the Company, on which he had for so long occupied a position of responsibility and had discharged it in the fullest possible way. Mr. Miles understood the gas business thoroughly, and had most amiable personal qualities. The Directors missed him very much indeed, and the Chairman felt sure that the proprietors would like to join with them in sending to Mr. Miles a message of sympathy on his retirement. [The proprietors indicated that this was their wish.] The Directors had elected Mr. Stanley Hunter Jones, M.Inst.C.E., to fill the vacancy on the Board due to the retirement of Mr. Miles, and had been extremely fortunate in having attracted Mr. Jones to the administration of the Company. For many years Mr. Jones had occupied the position of Engineer and General Manager of the third largest of the Metropolitan gas companies, the Commercial Gas Company, and on his retirement from that position the Commercial Company had very wisely and very promptly appointed him to its Directorate. He also administered several other undertakings, and his whole life had been devoted, and successfully devoted, to the theory and practice of gas administration. The Lea Bridge Company could congratulate itself upon having secured his services.

Increased Business and Dividend.

It would be noticed from the report that the increase in the Company's business during the year 1928 was 3·62 p.ct. He had been examining the reports of the largest of the Metropolitan companies with a view to ascertaining what they had accomplished during that period, and they had stated rather vaguely that the increase in their business was about 1 p.ct. That represented the degree of progress

made by the more important undertakings in London, so that the progress of the Lea Bridge Company was not only satisfactory, but favourable in its relation to that accomplished by other London undertakings.

The Directors recommended the distribution of a dividend of 8 p.ct. on the Consolidated Ordinary Stock. A year ago, when 7 p.ct. was recommended, the proprietors had seemed quite pleased with that; therefore, they should be more than satisfied with 8 p.ct., because the Directors could not have promised them that dividend.

The capital account disclosed that there was plenty of capital to call upon if necessary; and in some degree it would be necessary to call upon it, in view of the fact that the Company was developing so fast. During 1928 the Company had spent £15,693 of capital, and £12,848 had been written-off on account of depreciation. Therefore the position at the end of 1928 in respect of capital was more favourable than it was a year previously; and, as a matter of statistics, the capital absolutely expended on the undertaking, when a proper deduction had been made for the artificial amount added on conversion, totalled only about £415—which fact was worth recording and worth remembering, because it was the basis to which a low price of gas must inevitably be referred as a criterion.

Revenue Account.

There were some interesting figures in the revenue account. Coal, oil, and coke had cost £5561 less than in the previous year. Coal was cheaper; oil was nearly as dear in 1928 as in 1927; and the price of coke had followed the downward trend in the prices of residuals, and was a little cheaper as charged on the debit side of the account. As there was a credit on the other side of the account, however, that became almost a mere book entry. There were very few other items in the revenue account which did not march *pari passu* with the figures for the previous year. The cost of repairs of works and maintenance of plant, at 8¾d. per 1000 c.ft., had increased by over £1000. The other items were more or less comparable with those of the previous year, and there was brought to book a total charge for maintenance of just about 1s. 6d. per 1000 c.ft. That indicated that the Directors had ensured that things were all in order before they had attempted to strike any balance of profit. It was important always to look at that matter.

With regard to rates and taxes, although the Company had paid about £1000 less in 1928 than in 1927, nevertheless the amount to be paid in that respect was equivalent to nearly 3d. per 1000 c.ft. Matters were difficult in this regard in the East End of London, and there were instances, of which the Directors had full cognizance, in which large manufacturers and others had simply removed their businesses and had gone elsewhere because they could not meet the very high rates and taxes. That was a distinct disability to the Company in respect of its business; and rates and taxes constituted a very heavy charge upon its revenues.

He referred briefly to the item in respect of general insurances, because it would be realized that, in the light of recent events in Central London, gas undertakings demanded to-day a somewhat greater degree of protection in respect of accidents than they had in the past. The insurances had been increased in order to place the Company in what he believed could be called a position of absolute financial safety with regard to accidents in circumstances over which the Company had no control, such as that which had occurred in Central London. One could not pass that by unnoticed and unrecorded—one must realize its informative value to the gas industry. He assured the proprietors—and felt certain they wished to be assured—that the undertaking was fully insured in that regard.

Dealing with the credit side of the revenue account, he said the amount received in respect of gas meters, stoves, and fittings in 1928 was £8500 less than in 1927. The Directors had anticipated a year ago, in common with other Directorates, that there would be a heavy fall in the receipts from residuals; but taking gains and losses altogether, they were only £253 worse off than they were 12 months ago. In addition to having avoided what they had considered would be a greater loss, the knowledge they had accreted in regard to this matter during the past 12 months had led them to form a very encouraging view with regard to residuals, and particularly the major one, coke. In common with a great many undertakings, although they were coke sellers, they had no coke to sell. Most companies were even selling hot coke from their yards as quickly as it was made; and that fact indicated some change in the public demand which they were not slow to recognize and would promptly encourage and meet. The change was the demand of the small householder for coke, which demand did not exist before the war. The Officials of the Company were keenly alive to this, and would realize all that was possible from this new form of retailing coke. He did not think they need be frightened as to what would happen to them in the current year. The epitome of the whole matter was that the receipts had fallen by £8742, but that was partly counterbalanced by a decrease in expenditure to the extent of £3876, so that there was a decrease in profit of £4866.

Profit and Loss Account.

With regard to the profit and loss account, £30,195 had been brought in, and there was a balance of nearly £5000 more than that to be carried forward to next account, so that to this extent they had improved their position in spite of the very important disbursements to which he had referred, some of which they would not encounter again. There had been a transfer of £4410 to reserve fund, and that had been augmented by the accrued interest. The £31,000 odd which was shown to be in the reserve fund at the end of 1927 was fully invested in proprietary gilt-edged securities. Regarding the special purposes fund, again there was a full investment of a fund which quite commonly was not so completely dealt with in that way.

The Benefit Fund.

In order to understand the position in regard to this fund, it was necessary to recall its history. It was sanctioned as long ago as 1912 by what was called the Benevolent Fund Bill. They were allowed to take ½d. for every 1000 c.ft. sold and transfer that amount to the Benefit Fund, which fund was limited to five years' accretion of that authorized payment. It was perfectly obvious that if that were the proprietary contribution in 1912, and if the fund were of dimensions consistent with the duties attaching to it at that time, when the wages of the personnel affected were something like half what they were now, when the cost of living was lower and the value of money was greater, it could at least be said that after 17 years some other standard of payment and accretion should be sanctioned at present. They had succeeded in the interim in using the financial margin given to them as to meet all requirements. The amount paid in 1928 was £1208, and with the sanction he had referred to there had been transferred £1356 from revenue account. The amount transferred from revenue account proved to be more than necessary to meet all charges on the fund, after 17 years of its history. The total of the fund had reached £8980, and that was the limit until the Company were able to sell more gas and had more half-pennies to transfer. They could not very well treat this matter merely from the *prima facie* aspect. The recognized standard upon which these funds were regulated was an actuarial one. There was a special form of accountancy and a special form of financial technical treatment; but however difficult and apparently inexplicable such matters might be, it was the governmental standard by which these funds were regulated, governed, and sanctioned, and therefore they must sooner or later ascertain from that point of view what their obligations were. When that disclosed, as he felt sure it would, that the Company needed more ample powers and provisions than were obtained in 1912, they would have to ask Parliament to allow them to re-constitute the basis of this fund, so that it might meet the theoretical or technical requirements which might be shown to connect themselves with it. It would involve application for further governmental authority, and in due time they would be constrained to adopt that course.

Balance-Sheet.

There was a great deal in the balance-sheet that was very encouraging. The reserve fund and special purposes fund, as invested, had a book value of £61,451, and an actual value of nearly £67,000. Also there was on deposit with the banks £46,000 odd, so that they had all that was necessary to meet the requirements of the Company's business now and *in futuro*. There was a provision of £18,285 for future renewals of vertical retorts. It was extremely difficult to deal with certain forms of plants by regular debits of the revenue account when that plant assumed certain dimensions, and when the probabilities in connection with it went beyond what one might call the ordinary annual charge. It afforded another protective asset; it stood between them and any abnormal expenditure which might be incurred in any particular year as a feature of this particular kind of plant. It was at least an insurance of the plant.

Co-Partnership.

The amount of the co-partnership fund was £15,462; and in view of the fact that the co-partnership scheme had been working for only seven years, he considered that this was a great accomplishment. Of course, one did not look to a financial statement to reflect all that co-partnership meant or all that it had done. They could not have had a better example of what co-partnership meant to them than the spirit and success with which the recent abnormal demands made upon the Company had been met. This was equally true of all undertakings which had adopted co-partnership; but the way in which these extraordinary and exacting circumstances had been met was totally different in the case of co-partnership undertakings and those in which there was no co-partnership. He had knowledge of both types of undertaking, and he personally would need no more re-assurance as to all he hoped and expected of co-partnership than was afforded by the difference shown under conditions of co-partnership and under normal industrial conditions.

Low-Temperature Carbonization.

He was receiving continually letters of inquiry from proprietors of this and other undertakings with regard to low-temperature carbonization, which had loomed rather large in the public view during the last year or so. One could understand, in view of what had been claimed for it, and what had been written about it, that it was calculated to have a disturbing effect upon the minds of the ordinary gas investors who had no very profound knowledge of the industry in which they had invested their money. The gist of these inquiries was as to whether low-temperature carbonization threatened or menaced their interests in any way, whether it was coming into competition with the stable gas industry, and whether it should cause apprehension as to the future prosperity and security of their investments. He had replied to this question in various ways, but always to the same effect. The real facts were simply that there was nothing in any form of low-temperature carbonization which was not comprised and compassed within the practice of ordinary coal carbonization as carried out by the gas industry. Prof. Armstrong—a very eminent authority—had stated at a recent meeting that taking this thing in its fullest significance, it meant a reversion to the earlier type of carbonization adopted at the beginning of the gas industry, when iron retorts were used, when temperatures were necessarily lower, and the very fuel which seemed to be contemplated now was produced. The gas industry had soon realized, however, that this method of carbonization resulted in a limitation of output of the gaseous product, and that they must adopt methods by which they could produce the essential commodity of the industry in the greatest possible volume. It must be remembered, said the Chairman, that the thing which the gas companies had to sell, and which was the nucleus and backbone of the gas industry, was gaseous heat. They could sell it anywhere to anyone who wanted it; but they could not sell heat in any other form so readily and so generally as they could in the gaseous form. There was another matter to be considered—namely, that at present there

was a widening market for coke produced by the gas industry, and there were empty coke yards throughout the industry. The purposes for which coke was required were extending, and it seemed, therefore, that whatever might be provided in the way of smokeless fuel, the demand for coke would not become less. Therefore, anything that was done must be in supplementation of the production of coke, and not to displace coke as a commodity. As one having some responsibility in these matters, he said he was convinced that any variation in the process of carbonization which adversely affected or deteriorated the generation of the gaseous product must be doomed to economic and practical failure. Gas making was the backbone of the gas industry; and if they subordinated that to any passing phase or change, then he believed that the prosperity of the industry would be menaced. While, however, they continued to give the largest possible amount of gas of the proper quality at the lowest price to the public that demanded it, the future of the gas industry would never be menaced.

Mr. G. W. CAREY (Deputy-Chairman) seconded the motion for the adoption of the report and accounts, and it was carried unanimously, without discussion.

DIVIDENDS.

On the motion of the CHAIRMAN, seconded by Mr. E. L. BURTON, dividends were declared for the half-year ended Dec. 31, 1928, at the rates of 5 p.ct. per annum on the 5 p.ct. preference stock, 6 p.ct. per annum on the 6 p.ct. preference stock, and 8 p.ct. per annum on the consolidated ordinary stock, all less income-tax, and payable on Tuesday, March 12. The resolution also authorized the transfer to the reserve fund of £4998 17s. 10d.

RE-ELECTION OF DIRECTORS.

The CHAIRMAN, moving the re-election of Mr. G. W. Carey (Deputy-Chairman), assured the proprietors that, in so far as they could congratulate themselves upon the advance and progress of the Company, Mr. Carey's share in promoting this had been a very large one indeed. His co-Directors looked forward confidently to retaining his advice and co-operation, and strongly advised the proprietors to re-elect him to the Board.

Mr. S. H. JONES seconded, and the resolution was carried unanimously.

Mr. CAREY briefly returned thanks.

DIRECTORS' REMUNERATION.

The CHAIRMAN then moved that the remuneration of the Directors be increased by £500 per annum as from Jan. 1, 1929. It had been customary in the Company, he said, to review this matter at quinquennial periods, and five years had elapsed since it was last dealt with. The Company had not stood still in the meanwhile. In 1923 they had charged as a maximum price 11d. per therm. To-day they had issued notice of a reduction to 8·4d. per therm, representing a reduction in the period of five years of 2·6d. per therm. This meant that the price of gas as at present sold would cost the consumers £51,000 a year less than it had five years ago, and that was a big reduction. With regard to dividends, these had risen from 6½ p.ct. in 1923 to 8 p.ct. to-day, so that the proprietors had had their share in the general development. It was not, comparatively speaking, a large share compared with what the consumer received, but he was sure it would be acceptable in the circumstances, and it compared favourably with the yield of money invested in gas undertakings generally in similar circumstances. In view of these two facts and the general progress and advance of the Company, he felt sure the proprietors would not grudge the Directors some recognition for the responsibilities sustained and the duties discharged.

The resolution was seconded by Mr. CAREY and carried unanimously, and the CHAIRMAN briefly returned thanks.

On the motion of Mr. W. B. FARQUHAR, seconded by Mr. A. H. MOORLEY, Mr. R. E. Gisburne, F.C.A., was unanimously re-elected Auditor for the Company.

VOTES OF THANKS.

The CHAIRMAN moved a hearty vote of thanks to the officers and men of the Company, not only for their good work during the year 1928, but also for their great efforts during the beginning of the present year, when the demands upon all forms of public utility undertakings, and particularly gas undertakings, had been very great. The gas industry had had its full quota of anxiety, but he was sure the proprietors would like to know that this Company had been eminently successful in meeting every demand made upon it. It supplied a somewhat poorer element in the East End than did the greater companies, and gas was an absolute necessity to this poorer element. They must have their food cooked and their houses kept reasonably warm, and they looked to the gas companies to provide the means to do it. It would have been a very bad thing for the Company if it had failed to meet the greatly increased demand. It had not failed to meet the demand because it was so excellently supported by the skill of its executive officers and the devoted services of the co-partners.

The vote of thanks was seconded and carried with acclamation, and Mr. HENRY HAND (Secretary) and Mr. D. C. CROSS (the Engineer and Works Manager, speaking on behalf of Mr. F. W. Cross, General Manager, who was unable to be present through indisposition) briefly responded.

Mr. R. E. GISBURNE proposed a vote of thanks to the Chairman and Directors for the excellent manner in which they had looked after the shareholders' interests during the past year. This Company, he said, had no ordinary Board of Directors; it was a Board of experts, and the Chairman was a special expert in the gas industry. Mr. Gisburne also drew attention to the fact that the reserve fund, special purposes fund, and other funds were fully invested in first-class securities, which was a pleasing feature and an indication of the strength of the Company.

The vote of thanks was seconded by Mr. HARFORD ROBERTS and carried unanimously.

The CHAIRMAN, in a brief response, said that the policy of investing funds in gilt-edged securities had the consensus approval of his colleagues. They firmly believed that all these investments should be independent of the general business of the undertaking.

The meeting then closed.

NORTH MIDDLESEX GAS COMPANY.

The Ordinary General Meeting of the Company was held on Monday, March 4, at 5, Great Winchester Street, E.C.—Mr. A. M. PADDON, M.Inst.C.E. (the Chairman), presiding.

The SECRETARY (Mr. Hyde C. Burton, A.C.A.) read the notice convening the meeting; and the report of the Directors and statement of accounts for the year ended Dec. 31 were taken as read.

PRICE OF GAS REDUCED.

The CHAIRMAN, in moving their adoption, said that, in considering the report and accounts, the proprietors would have noticed that the increase in the Company's business had not been sensationally large; but in comparison with the returns from the more important gas undertakings in their area, it was a big one. As a matter of fact, the sale of gas for the year showed an increase of 2·83 p.ct. as compared with that for the preceding year; whereas the increments in sales in the case of certain predominant undertakings had seldom exceeded 1 p.ct. over the same period. The report also informed them that the price of gas had been reduced from 10·2d. to 9·8d. per therm; and he was glad to be able to supplement this by telling them that the charge would be further reduced as from the current month to 9·4d. per therm. This would represent a total reduction of 0·8d. per therm, and would mean that they were conceding to the public nearly £12,000. The Directors recommended a final dividend at the rate of £7 1s. p.ct. This was an increase upon the distribution of the previous year, which amounted to £6 18s. p.ct. This indicated that the proprietors might hope for a little better return later on. During the year under review, there had been expended on capital account just over £11,000; but at the same time there had been written off £7000 by way of depreciation, so that the net result was an increase of only about £4000 in the capital expended. In connection with this, it might be pointed out that they had sold some 20 million c.ft. of gas more, so that the relation of capital to business had improved, as compared with twelve months ago. As a matter of fact, the capital employed by the Company amounted to no more than £517 per million c.ft., which was less than that of some of the largest undertakings in the kingdom. Repairs and maintenance charges amounted to over 18d. per 1000 c.ft. Receipts for gas were some £10,000 less; but this, of course, was in consequence of the reduction in price. Rentals of meters, stoves, and fittings had increased by £714. The returns from residuals, taken in the aggregate, showed a reduction, when compared with twelve months ago, of only £639. This was a remarkable result, when considered in the light of the results of other gas undertakings. While the total receipts had been reduced by more than £10,000, the expenditure was less by nearly £13,000, and the profit was £2286 more. When the final dividends had been paid, there would be a balance remaining of £5179, which was an improvement of something like £1300. It would be seen by the balance-sheet that the total amount standing to the credit of co-partners was £14,132. This showed the considerable progress being made with the system, which had proved a great success.

Summing up the position, the Chairman said that at the present moment one of the most re-assuring factors of the gas industry was the strength of its residuals. This question of residuals would stabilize their accounts, and in combination with various economies would enable the Directors to present to the proprietors a statement of accounts for the next twelve months at least as favourable as those which were being submitted that day.

The DEPUTY-CHAIRMAN (Mr. H. A. Lermitte) seconded the resolution, which was unanimously carried.

On the proposition of the CHAIRMAN, a final dividend was declared on the consolidated ordinary stock, making for the year a distribution of £7 1s. p.ct., *less* income-tax.

The retiring Directors (Messrs. H. A. Lermitte and G. W. Carey) were re-elected; and the Auditor (Mr. W. B. Paton, A.C.A.) was re-appointed.

It was also decided, owing to the development of the Company's business, to increase the remuneration of the Directors by £438 a year.

The CHAIRMAN, who proposed a hearty vote of thanks for their services to the officers, their staffs, and the co-partners generally, remarked that for fourteen consecutive days during the recent cold spell the output of gas showed an increase of 60 p.ct. This indicated the anxious times through which they had successfully passed. There was every reason to be proud of the manner in which all connected with the Company had worked to overcome the difficulties.

Mr. FRANK H. JONES seconded the vote, which was heartily accorded, and acknowledged by Mr. LAWRIE TREWBY (Engineer and Manager).

The Chairman and Directors were thanked on the motion of Mr. C. H. RUTTER.

SERVICE RECORDS OF LIVERPOOL GAS EMPLOYEES.

Striking long service records of employees of the Liverpool Gas Company were mentioned by the CHAIRMAN (Mr. H. Wade Deacon) at a gathering, at the concert for co-partners of the Company, on the evening of March 4, in the Central Hall.

The longest record, said the Chairman, was that of a man who died a few years ago, aged 99, after 72 years' service. Another, who retired last year, had served 61 years. There were at present in the Engineer's Department 47 men who had been with the Company between 40 and 50 years, and 11 who had served more than 50 years. In the Treasurer's Department there were 7 who had served more than 40 years. When men stayed a lifetime with a company it apparently indicated that they were happy and contented.

TWENTY-FIVE YEARS' PROGRESS.

Reviewing outstanding features of his 25 years' Chairmanship, Mr. Deacon said that in that period the Company's output of gas had doubled, and the number of consumers almost doubled, while the number of appliances supplied had increased enormously. Twenty-five years ago they had only 2600 cookers and fires on hire. Now there were more than 111,000 on simple hire, and, taking into account those which had been bought outright or on the hire system and those installed in Corporation houses, there were more than 200,000 pieces of apparatus now using gas.

Alluding to the advantages of co-partnership, Mr. Deacon said that last year gas consumers in the Liverpool area benefited to the extent of £129,000 by the reduction in price. The co-partners, of course, participated in that reduction as consumers, and in addition their bonus on wages was increased from 5½ to 6 p.ct. and their dividend as stockholders advanced by the same figure. Co-partners also had the privilege of buying coke at a lower price than anyone else.

£121,000 DISTRIBUTED.

Under the co-partnership scheme, which was instituted in 1911, the Company agree to employ the co-partner for a definite period and to pay him a bonus on his wages, one-half of which is not withdrawable, but is invested in the ordinary stock of the Company. Since the scheme began £121,576 had been distributed. At the end of last year there were 2285 co-partners, and their financial interest in the Company amounted to £106,077.

Most of the artistes taking part in the concert were co-partners.

CONTINENTAL UNION GAS COMPANY, LTD.

Presiding at an Extraordinary General Meeting of the Company on Tuesday of last week, Col. H. LEROY LEWIS (the Chairman) stated that when he last addressed the stockholders, the prospect which seemed to present itself was not particularly gratifying, as they could only expect that any plan of re-organization would call for heavy sacrifices to be made. The outlook had, however, now been fundamentally altered, and, instead of a somewhat gloomy picture, a totally different prospect was in sight, which would involve no sacrifices, but, on the contrary, provided a gratifying expectation of substantial rewards. That was the culmination of 24 years of unremitting and arduous work.

In the course of a review of the history of the Company, he said that after the official stabilization of the French franc in 1927 the Board had set to work to deal with the capital account and the re-organization of the Company, by reducing as far as possible the fatal preponderance of the French assets. On Dec. 12 they realized that they were about to make a satisfactory sale of the shares in the Union des Gaz, and on Dec. 19 they were able to send a circular informing the stockholders that their capital was more than saved. The purchase of the shares was to be made by a group of French gas and electrical undertakings, and the Directors had decided to accept the sum of £1,200,000 for their holding, subject to no deduction other than stamp duty on the transfer. He hoped stockholders would consider this to be not a bad result, especially when they realized that the market value of their Union des Gaz shares was at the time about £600,000.

He then proceeded to deal with the proposals on the lines of the circular which was reproduced on p. 617 of the "JOURNAL" for Feb. 27. The scheme was approved by the preference stockholders.

AMALGAMATION OF TUNBRIDGE WELLS AND CROWBOROUGH.

The following points in regard to the proposed amalgamation with the Crowborough Company were mentioned at the Annual Meeting of the Tunbridge Wells Gas Company on March 1.

When sanction is obtained, amalgamation with the Crowborough Gas Company will be completed, and the Tunbridge Wells Company will commence a new high-pressure main, some 11 miles long, to convey gas from the works to the Crowborough holders. This will benefit the Crowborough consumers, who will obtain better service at a lower price after the first year—viz., from 16d. per therm to 13d. per therm. The existing stocks will be converted and consolidated into two stocks only, viz.: (1) Sliding-scale stock, which would be entitled to receive, out of the profits of the Company, a standard rate of dividend of 4 p.ct. per annum, rising or falling at the rate of 4s. p.ct. per annum for each decrease or increase of one-fifth of a penny per therm in the highest price charged to ordinary consumers, as compared with the standard price of gas—at present 16d. per therm; (2) maximum stock, which would be entitled to receive out of the profits of the Company a dividend of 5 p.ct. per annum so long as the dividend paid upon the sliding-scale stock shall be at the rate of not less than 2½ p.ct. per annum, or if such dividend be less than 2½ p.ct., then at double the rate of dividend on the sliding-scale stock. The new stocks would be transferable in amounts of £1 or multiples thereof, by reason of which they would be more marketable. The conversion will not in any way affect the dividend.

Additional capital will be required for the new main to Crowborough, and renewals to purifying and other plant; also to pay off the Crowborough redeemable debenture and preference stocks due in 1930, and the Tunbridge Wells Company's own £20,000 7 p.ct. redeemable debenture stock in 1931.

RECORDS BROKEN AT SMETHWICK.

The CHAIRMAN of the Smethwick Corporation Gas Committee (Alderman A. M. Willicts) addressed the Town Council on Wednesday, March 6, on the recent progress of the Gas Department.

During the past four weeks, said the Chairman, the increased consumption was 17·37 p.ct. when compared with the corresponding period of last year; in 1928 the consumption was 77,378,400 c.ft., and for the last four weeks it was 90,820,900 c.ft.—an increase of 13,442,500 c.ft. A record was established on Feb. 13, when no less than 3,712,000 c.ft. of gas were supplied during the 24 hours. The previous record was on Dec. 12, 1928, when the gas consumption was 3,643,000 c.ft. The record week for the Undertaking was the period ended Feb. 19, when there were no less than 23,845,100 c.ft. of gas sent out from the works; the prior record being in a week of December last, with a consumption of 23,017,000 c.ft.

In regard to coal, they had an exceptionally difficult task in getting supplies, while at the same time they were experiencing an unprecedented demand upon the undertaking. For the four weeks there were carbonized 5136 tons of coal, against 4052 in the corresponding period of 1928—an increase of 1084 tons, or 26·75 p.ct. Facts such as these would indicate the character of the demands made upon the men at the gas-works, those connected with the distribution services, and the officials and staff whose responsibility it was to maintain those services.

DANGER OF JOINT USE OF PREPAYMENT METERS.

The danger of one prepayment gas meter supplying two tenants was emphasized by Sir Walter Schroder at St. Pancras Coroner's Court at an inquest on the body of A. W. Morris, who was found gassed in bed at a house in Eton Street, Regent's Park, on Feb. 24.

An inspector of the Gas Light and Coke Company stated that the gas supply to Morris's room was by a slot meter, which also supplied another room.

The Coroner asked whether there was a rule about the one meter supplying different rooms. The inspector replied that they never installed a meter if that was intended. He added that when the meter was fixed it was intended to supply two rooms occupied by one tenant, but at a later date the rooms were let separately.

Recording a verdict of "Accidental death," Sir Walter Schroder said: "The gas supply to Morris's room also supplies another room. The gas in his room might be alight, and then the tenant of the next room comes in and lights his gas. The supply becomes exhausted, and the light in Morris's room goes out. The other tenant puts additional money in the meter and the gas escapes in Morris's room, where the tap is still turned on, and he is gassed."

THE NORTH-EAST COAST EXHIBITION.

Rapid Progress.

Excellent progress is being made with the construction of the North-East Coast Exhibition, Newcastle-upon-Tyne, which is to be opened on May 14 by H.R.H. the Prince of Wales. Occupying some 100 acres on the Town Moor, within easy reach of the heart of the city, the Exhibition gives every promise of being a great success. One of the objects the promoters have in view in holding the exposition is a strong effort to stimulate the revival of trade on the north-east coast, which has suffered so much in recent years from commercial depression. Whether this will be achieved or not is a matter which cannot be answered at the moment, but there is a feeling of hopefulness that a good deal of prosperity will accrue.

The two main buildings which are to house the principal exhibits—the Palace of Industries and the Palace of Engineering—are complete. The exhibitors are now in possession of the former edifice, and once the concrete foundations are laid for the heavy machinery, the engineering exhibits will begin to arrive.

The forward state of preparedness of the exhibition was commented on a few days ago, when the Lord Mayor of Newcastle-upon-Tyne, Councillor A. W. Lambert, Chairman of the Executive, along with members of the Executive, members of the various sub-committees, and their lady friends visited the site. The company numbered some 600, and everyone was impressed with the satisfactory condition of things. Moving from one building to another were visitors who remembered Newcastle's exhibition in 1887, and expressed amazement at the 1929 show.

The Exhibition will be fully representative of the numerous industries which have made the North-East Coast famous throughout the world.

GAS COMPANIES' RESULTS FOR 1928.

Steady Progress Maintained.

ANNFIELD PLAIN.

The annual report of the Annfield Plain and District Gas Company (Co. Durham) shows receipts for the year amounting to £5852 against an expenditure of £4116, leaving a balance of £1735. After providing for interest on loans, income-tax, and a debit balance of £1927, there remains a balance of £576 to be carried forward.

AYLESBURY.

The report for the half-year ended Dec. 31 of the Aylesbury Gas Company shows that the Directors recommend the payment of a dividend at the rate of 5 p.ct. per annum for the half-year, *less* tax, upon the consolidated ordinary stock.

BURNHAM.

A year of progress was reported at the Annual Meeting of shareholders of the Burnham Gas Company, held at the Company's offices, Oxford Street, on Saturday, Feb. 23, Mr. John Cox (Chairman of the Directors) presiding. The Directors' report stated that during the year consumers had been offered a graduated scale of discounts according to quantity consumed and for prompt payment, and the Directors believed this would lead to extended business, in addition to being greatly appreciated by consumers. The new "Moore" gas generator plant foreshadowed in the last report had been working satisfactorily since April, the carbonizing results being very considerably improved. The increase in the quantity of gas sold had been 2·4 p.ct., or 1,071,000 c.ft. The balance of the year's revenue account was £2500, which, added to the sum of £702 brought forward from the previous year, made £3203. Income-tax, bank charges, &c., and interim dividend declared on Sept. 1 last had been paid, and there remained a balance of £1953 to be dealt with. The Directors accordingly recommended the payment of dividends (*less* income-tax) for the half-year ended Dec. 31 at the following rates: Original capital shares £11 5s. p.ct. per annum; additional capital shares, £7 17s. 6d. p.ct. per annum; and new capital shares, £6 15s. p.ct. per annum. It was also recommended that the sum of £125 be transferred to the reserve fund, leaving £1048 to be carried forward to the next year's account. It was proposed to expend a sum not exceeding £1000 on cooker renewals during the ensuing year. They contemplated during the present year inaugurating a scheme of free periodical inspection and adjustment of all gas burners and other gas appliances. Up to June 30 last the calorific standard was 480 B.Th.U. per c.ft., but since that date they had been supplying gas of 450 B.Th.U. quality. The sale of gas per ton of coal and coke gasified increased from 12,939 c.ft. in 1927 to 15,184 c.ft. in 1928. Notwithstanding the fact that they produced nearly 1¼ million c.ft. more gas during 1928 than in 1927 the total expenditure on carbonizing wages was £206 less in 1928, though the 1927 expenditure under the same head was the lowest for several preceding years. The reduced expenditure was the result of the new plant.

During 1928 they laid 880 ft. of 6-in. steel main in Abingdon Street, and 390 ft. of 3-in. steel main in St. John's Road. They also laid 2981 ft. of new service pipe, and renewed 591 ft. of old services. The number of gas meters in use was 1489, as compared with 1401 the previous year, and the number of cookers on hire was 819, as compared with 768. In conclusion, the Chairman had no hesitation in saying that the year 1928 was one of the most notable and successful in the history of the Company.

CANTERBURY.

That 1928 was a record year in the history of the Canterbury Gas and Water Company, was reported at the Annual Ordinary General Meeting held at the offices of the Company on Feb. 25; the Chairman of the Directors (Mr. Silas Williamson, J.P.) presiding. The Chairman, moving the adoption of the Directors' report, said that the gas department had followed normal conditions during the past year, and had yielded a good return on its capital. There had been a reduction of £1340 in expenditure as compared with the preceding year. The receipts for sale of gas, residuals, &c., showed a drop of £4903, which was due to the reduction in the price of gas, which was 12d. per therm for nine months and 11¼d. per therm for three months during 1927, as compared with 11d. per therm for the whole of 1928; also to a big drop in prices realized for residuals, which during 1927 were abnormal immediately following the coal strike. The quantity of gas sold during 1928 amounted to 765,020 therms, as against 753,462 in 1927, being an increase of 11,558 therms; and the unaccounted-for gas was 7 p.ct. The gas mains were extended by 577 yards; and 99 new gas services were connected, and 112 new cookers, 70 gas fires, and 19 radiators were fixed during the year. The amount carried to the profit and loss account for the two departments was £14,421. This enabled the Directors to recommend a uniform dividend of 10 p.ct. on the total capital of the Company, being the same as last year. Mr. F. Amos seconded, and the report, accounts, and balance-sheet were unanimously adopted.

CASTLEFORD.

The annual report of the Directors of the Castleford and Whitwood Gaslight and Coke Company shows that a final dividend of 5¾ p.ct. on the original stock, and £4 1s. p.ct. on the additional stock has been declared.

CHELTENHAM.

The Directors' report of the Cheltenham Gas Light and Coke Company for the year ended Dec. 31, 1928, shows a profit for the past year of £19,271. The Directors propose to continue their policy of building up the contingencies fund by setting aside a further sum of £5000 out of the profit and loss account, thus bringing the fund up to £22,500. The quantity of gas sold to consumers during 1928 was 545,047,800 c.ft., an increase of nearly 12 million c.ft. over the amount sold in the previous year, and nearly 4 million c.ft. more than the amount sold in 1926, which was an exceptional year for the sale of gas. The retort houses and machinery at the works have been kept thoroughly up to date, and reductions in expenditure have been effected both in manufacture and distribution, as was foreshadowed last year. Enlargements of the mains in the Leckhampton area have been carried out, and owing to the increase in consumption, the Directors have the enlargement of mains in other important areas under consideration. A reduction in the price of gas was made as from the March readings of the consumers' meters, and the Directors felt justified in announcing a further reduction in the price to 8¾d. per therm, to take effect after the reading of the meters for the December quarter, with the result that during the past 15 months the price of gas has been reduced from 9½d. to 8¾d. per therm, a reduction equivalent to 3½d. per 1000 c.ft. The Directors recommend the payment of a dividend at the rate of 5 p.ct. per annum on the paid up consolidated ordinary stock for the year ended Dec. 31, 1928, out of the profits for that year.

CORK.

The Hundred and Twentieth Ordinary General Meeting of the Cork Gas Consumers' Company was held in the board room at the offices, 72, South Mall, on Feb. 28; Mr. W. B. Harrington, F.C.S., Chairman, presiding. The report presented by the Secretary showed that, compared with the corresponding period of 1927, there had been a slight increase in the quantity of gas sold. The balance of profit and loss was £7455, with which the Directors recommended payment of the ordinary dividend at the rate of 8 p.ct. per annum and a supplementary payment of 2s. per share on account of arrears of previous dividends which were paid at reduced rates. The Chairman, in moving the adoption of the report, said that their business still continued to be very satisfactory, and though the quantity of gas sold was only a little in excess of the corresponding period, it would have been considerably more were it not for the exceptionally mild weather during the latter part of the year. There had been a substantial increase in the deliveries of gas during the past few weeks of cold weather. They fixed no less than 488 gas cookers and fires during the past six months, and there was also a satisfactory net increase of 202 in the total number of meters. In conclusion, the Chairman gave some facts in reference to the greater efficiency of the new "Beam" radiants; and the meeting closed with a vote of thanks to the Chairman on the proposition of Mr. C. McCarthy, supported by Mr. Walsh.

CROWBOROUGH.

The Annual Meeting of the shareholders of the Crowborough District Gas Company was held on Feb. 27; Mr. G. W. Howard (Chairman of the Board of Directors) presiding. The Directors' report stated that the amount of gas sold during the year to private consumers showed a satisfactory increase. The Company had completed the sale of the electricity side of the undertaking to the Weald Electricity Supply Company, and negotiations had been completed with the Tunbridge Wells Gas Company for the sale of the remainder of their undertaking. The revenue account showed a profit on gas during the year of £4899, which, with interest receivable, made an aggregate of £6652. To this was added the amount brought forward—£8648—making a total of £15,301. After all deductions had been made, there was a balance of £12,393, out of which the Directors recommended a dividend of 5½ p.ct. per annum, which would absorb £1650, and there would be a balance to be carried forward of £10,743.

EXETER.

The Annual Meeting of the Exeter Gaslight and Coke Company was held on Tuesday, Feb. 26—Mr. John E. Daw, the Chairman, presiding. The Chairman, in moving the adoption of the report, said that though last year was generally fine and warm, there was an increase in the Company's sales of over 14 million c.ft. (66,521 therms). The increase in business had been steady and continuous for many years. The sale of gas in 1918 was 444 million c.ft., whereas in 1928 it had risen to 688 million c.ft.—an increase of 244 million c.ft., or 55 p.ct. in 10 years. New and improved manufacturing plant which was put into operation early in 1928 had secured results which fully justified the expenditure. The high-pressure mains direct from the works to Pinhoe and Topsham had been completed and feeder mains laid into the general distributing system; and the outlying districts of the Company's area had had a more constant supply. A woman's advisory section to afford any customers assistance in the proper and economical use of gas for all domestic purposes had been started in connection with the showroom. At the first series of cooking lectures last autumn it was found necessary to repeat each lecture on account of the overwhelming attendance. Special arrangements had been made for the spring session of lectures. In addition, a course of lectures had been given by Miss Burlton on "Business Methods." The Chairman was glad to be able to

say that they saw their way to make a further reduction in the price of gas in the shape of 2½ p.ct. discount for prompt cash payment to all consumers by ordinary meter and a corresponding concession to the prepayment meter consumers. Additional discounts had also been given to large customers. Mr. H. M. D. Wilcocks seconded, and the motion was carried. The Directors' recommendation of dividends —4 p.ct. on the preference stock, 5 p.ct. on the preference shares, 7½ p.ct. on the new ordinary shares, and 10½ p.ct. on the original stock, all *less* income-tax, for 1928—was approved on the proposition of the Chairman, seconded by Mr. S. C. Snow.

GLOSSOP.

The report of the Directors of the Glossop Gas Company for the half-year ended Dec. 31, 1928, shows that the receipts for the six months were £15,069, and the net profit £2673, while the sum of £8372 was brought forward from the last account. The Directors recommend the payment of maximum dividends, after which a total of £9142 will remain to be carried forward.

GRIMSBY.

The report of the Directors of the Great Grimsby Gas Company for the year ended Dec. 31, 1928, shows that dividends are recommended at the rates of 7½ p.ct. per annum on the "A" and "B" stocks; 7 p.ct. per annum on the "C" stock; 6¾ p.ct. per annum on the £10 shares; and 4 p.ct. per annum on the preference stock.

HASTINGS.

The accounts of the Hastings and St. Leonards Gas Company for the year ended Dec. 31, 1928, show a balance of £28,720, to which has to be added £643 for interest, making an available total of £29,363. The amount required to provide for interest on debenture stock, consumers' deposits, income-tax, the interim dividends paid, and the dividends now recommended is £28,419. The price of gas was reduced, as from the readings of the meters in April last, to 10½d. per therm. There has been an increase in the number of consumers, and the demand for gas appliances of all kinds continues and expands. The unusually mild weather towards the end of the year naturally influenced the demand for gas and coke. The Company's supply is now available in the districts of Battle, Guestling, and Pett. To enable the existing oil gas plant to be overhauled and provide for some increased production, the Directors have authorized the installation at the Glyne Gap Works of a new plant with the latest improvements. Favourable forward contracts for coal and oil have been entered into, but as against this the markets for residuals are depressed. Interim dividends (*less* income-tax) were paid in September as follows: £7 p.ct. per annum on the 5 p.ct. converted stock; £5 10s. p.ct. per annum on the 3½ p.ct. converted stock; and £6 8s. p.ct. per annum on the 5 p.ct. additional stock; and the Directors now recommend that the final dividends for the year be paid at the same rates.

LAUNCESTON.

Presiding at the Annual Meeting of the Launceston Gas Company on Monday, Feb. 25, Dr. W. F. Thompson said that owing to the severe weather last month they had a record output of gas. On one particular day their output was 142,000 c.ft., the greatest daily output previously having been 98,000 c.ft. With an effective storage capacity of only 12,000 c.ft. that meant that their consumers suffered from reduced pressure, but they were increasing their storage capacity by putting in a new gasholder. A dividend of 10 p.ct. on the original shares, and of 9 p.ct. on the additional shares was declared.

LEATHERHEAD.

The quantity of gas sold by the Leatherhead Gas and Lighting Company has increased by 46 p.ct. in five years; 107 million c.ft. being sold in 1923, and 157 million c.ft. being sold in 1928. Those were among the figures, indicating progress made, reported at an Ordinary General Meeting of the Company held at the offices in North Street, Leatherhead, on Friday, March 1. The Chairman (Dr. L. Potts) mentioned that the Company hope to be able to make a series of gradual reductions in the price of gas. The Chairman, proposing the adoption of the Directors' report and the accounts, said he would like in the first place to draw attention to the continued and increasing demand for gas indicated by the following cogent facts: The sale of gas by the Company in 1928 exceeded 1927 by nearly 5 p.ct. During this period the number of customers increased from 3270 to 4583, an addition of 40 p.ct. Further, it was very satisfactory to find that the average quantity used per consumer had increased from 33,700 c.ft. in 1923, to 35,200 c.ft. in 1928. References were made by Dr. Potts to the reconstruction of the boiler house at the gasworks, and to the erection of new showrooms and offices on the old Bull Inn site. In conclusion, the Chairman said he would like to congratulate and thank the officers and employees of the Company for their splendid services during the past year, and especially the Engineer, Mr. Irving, who, during the period he had been with the Company, had reconstructed the whole works. At the present time, when the weather conditions had suddenly caused a temporary output of 50 p.ct. more gas, the task laid on their shoulders was no light one. He also thanked the Secretary, Mr. Young, who had spared no effort to secure the success of the Company.

LEYLAND.

The net revenue of the Leyland Gas Company for the half-year ended Dec. 31 was £1909, to which was added the sum of £1806, being the amount brought forward from the previous account. The Directors recommended the declaration of dividends at the following rates per annum: On the ordinary stock, 6 p.ct.; on the preference stock, 5 p.ct.; on the redeemable preference (1927), 7 p.ct.; and on the redeemable preference (1932), 5½ p.ct., all *less* tax.

NARBOROUGH.

The Directors of the Narborough, Blaby, Enderby, and Whetstone Gas Company state in their report to the shareholders that the sale of gas continues to increase. During the period involved in the accounts, 139 additional consumers were connected to the Company's mains, and arrangements had already been entered into for a similar number of consumers to be added during the current year. A commencement would be undertaken immediately to enlarge the trunk mains, and also new exhausting plant was being erected. The recommendations are to pay a final dividend on the ordinary shares of 2s. 6d., *plus* a bonus of 2s. 6d. (equal to 15 p.ct. on the ordinary capital), transfer £1000 to renewals fund, leaving to be carried forward the sum of £7262.

NEWMARKET.

The Annual Meeting of the Newmarket Gas Company was held at the Company's office on Monday, Feb. 25; Mr. R. Stephenson, J.P., D.L. (Chairman), presiding. The Directors' report was as follows: The balance brought forward from last year is £10,911; *less* debenture interest paid for the year 1928, £162; leaving £10,749. The profit earned during the year ended Dec. 31, 1928, is £2230; making a balance at the credit of the profit and loss account of £13,000. The Directors recommend that out of this amount a dividend be paid at the rate of 8¾ p.ct. for the year 1928 upon the £60,000 original consolidated stock of the Company, less income-tax; and at the same rate for the quarter ended Dec. 31, 1928, upon the £5000 new stock paid up on Oct. 1, *less* income-tax; total, £4287; leaving to be carried to the next account, £8712. The new carbonizing plant was brought into operation last October, and the Directors are pleased to say it is working satisfactorily. The Chairman, in moving the adoption of the report and accounts, said he was very pleased to see such a good attendance as they had that day. The result of the year's working was very much what they had anticipated. The new plant was quite satisfactory—without it they could not have supplied all the gas that had been used during the recent cold spell. It had not been put in a minute too soon. Their consumers, during the year, had saved nearly £1300 on their gas bills in consequence of the reduction in the price to 11d. per therm, and the shareholders were entitled to an extra dividend of £375. The receipts from the sale of gas were down by £1273. That followed, of course, on the reduced price of gas. Residuals were down to no less than £2094. On the other hand, manufacture and distribution were lower by about £920. In conclusion, a vote of thanks was proposed by Mr. T. R. Leader, supported by Mr. J. L. Jarvis, to the Manager and Secretary (Mr. J. H. Troughton) and his staff, who were chiefly responsible for the fundamental success of the business. Mr. Troughton replied suitably.

ROMFORD.

The Chairman (Mr. Bevous J. Smith) presided over the half-yearly meeting of shareholders of the Romford Gas Company on Saturday, Feb. 23. In moving the adoption of the statement of accounts and report, the Chairman said that the half-year's sale of gas had increased by 12 million c.ft., or 6·87 p.ct., thus making the total increase for the year 35 million c.ft., or 9·99 p.ct., which, in face of the severe competition, might be regarded as eminently satisfactory. The production of gas reached roughly 400 million c.ft. during the year (the actual figure being 397½ millions). The number of consumers added to the rental roll during the half-years was 828, thereby bringing the total number up to 11,571, as compared with 10,169 at December, 1927, an increase for the year of 1402. New appliances disposed of during the year, such as cookers, fires, coppers, geysers, &c., showed an increase for the year of 1901. The laying of new mains of practically 3½ miles in length had called for an expenditure of £3958, and meters to meet the requirements of new consumers during the half-year had cost £3026, while the various new appliances accounted for the sum of £6442. Coals cost £662 less than in 1927, the tonnage carbonized being rather less, due to the fact that the percentage of coal gas was somewhat smaller than in 1927. Repairs and maintenance of works necessitated an expenditure of £11,457, including among other items the replacement of the carburetted water gas plant at a cost of £7545. The price charged for gas during the half-year was 10d. and 10·6d. per therm, as compared with 10·6d. and 11·2d. in 1927. This reduction of 0·6 of a penny per therm represented a sum of £2113 for the half-year, to which extent the consumers benefited. The total revenue amounted to £45,617, and expenditure to £36,542, leaving a net revenue profit of £9074, and the Directors recommended the payment of a dividend at the rate of 7½ p.ct. on the original shares, and 6 p.ct. on the "B" shares, leaving a balance to be carried forward of £3469.

ST. AUSTELL.

Presiding on Monday, Feb. 25, at the 59th Annual Meeting of the St. Austell Gas Company, Mr. S. J. Ingram said that their revenue had been less in consequence of the reduction in the price of gas, but their profits showed an increase of £100 over those of the previous year. The statement of accounts showed that the sales of gas had increased by 694 c.ft., and the number of consumers by 29. The balance standing to the credit of the profit and loss account amounted to £1596. A dividend of 8½ p.ct. on the ordinary shares, and of 7 p.ct. on the new shares, was declared.

LONDON COUNTY COUNCIL AND GAS LIGHTING.

At the meeting of the London County Council on March 5, Lt.-Col. J. B. DODGE (Mile End) asked the Chairman of the Education Committee whether the Council had considered modernizing the system of lighting at the Ben Jonson School, and whether details of the proposed alterations could be given and the likely date when the work would be put in hand.

Sir JOHN GILBERT (Chairman of the Committee) replied that quotations had been received for providing modern superheated gas burners to the existing fittings at the school. The quotations would be considered by the Elementary Education Sub-Committee at their meeting on the 12th inst., and the order to commence the work would be issued immediately the Education Committee had approved the proposals.

Lt.-Col. DODGE further asked if the question of installing electricity instead of gas would be reconsidered.

Sir JOHN GILBERT said that the question of electricity as against gas lighting in schools had been frequently very carefully considered by the Sub-Committee.

HASTINGS CO-PARTNERSHIP MEETING.

The Annual General Meeting of the Co-Partners of the Hastings and St. Leonards Gas Company was held on the evening of March 7, when there was a full attendance.

The CHAIRMAN of the Committee (Mr. A. M. Apel), in moving the adoption of the report and balance-sheet, said that 1928 had proved a successful year. Following the reduction in the price of gas, an increased bonus had been declared, and over £1000 of the Company's stock now stood to their credit. The contributions to the pensions fund for the year exceeded £850 and, at the present time, the fund held £2600 in War Stock. During the past three years £5500 had been set aside in the two funds by the Company for the benefit of the members. He urged upon all the necessity of using their best efforts for the common interest. If they satisfied the consumer, they benefited the Company, and at the same time themselves. He wanted them honestly to feel at the end of the year that their bonus was not a gift but an earning.

RECORD OUTPUT.

After the election of the Committee, Mr. C. F. BOTLEY, Secretary, reviewed the year's working, which he considered very satisfactory. Nearly 1000 gas appliances had been sold. He appreciated very much their efforts during the recent exceptionally cold weather, when all records were broken with one day's manufacture of 2,668,000 c.ft. of gas. He regretted that some consumers had been inconvenienced by temporarily losing their supply of gas through frozen pipes, but everything would be done to avoid a recurrence of this.

The meeting closed with votes of thanks to the Chairman, Secretary, and Committee.

THAMES CONSERVANCY AND LAND FOR THE GAS LIGHT AND COKE COMPANY AT STAINES.

At the last meeting of the Thames Conservancy Board the Chairman, Lord Desborough, presented a report of the Works, Navigation, and Regulation of Water Committee, stating that they had had under consideration the provisions of the Bill promoted by the Gas Light and Coke Company seeking power *inter alia* to acquire compulsorily a piece of land belonging to the Conservators adjoining the towpath off the Company's Works above Staines Road Bridge, and to use the same for the purposes of their undertaking, including the manufacture and storage of gas and residual products. Since the Committee's decision on Feb. 11 last to confirm the objection embodied in the petition deposited by the Parliamentary Committee against the compulsory acquisition of the land, the Company had made further representations materially modifying their original proposal, and stating that they were prepared, if the Conservators would sell the land and withdraw their petition against the Bill, to undertake not to erect a gasholder thereon, to build a wall of such height and character as might be agreed, and to plant a row of trees in front of the land.

The land in question, known as Stone Eyot, was purchased by the Conservators in 1885 for the purpose of making a new towing path, the former path having been washed away. More land had to be purchased than was necessary; the spare land had from time to time been used as a dumping ground for dredged material; and there now remained only 1¼ acres.

OPPOSITION WITHDRAWN.

In view of the amended proposals put forward by the Company, the Committee felt that the aspect of the matter had been changed, and they further considered the matter at a special meeting on Feb. 25. They were of opinion that, in view of the restrictions offered to be placed upon the use of the land, and of the further protection of the local amenities which would be afforded by the proposed screen of a wall and trees, it would be in the Conservators' interest to dispose of the land by agreement instead of making the matter the subject of an expensive and possibly uncertain Parliamentary contest. They had therefore authorized the Chairman of the Board to negotiate with the Company on the basis that, provided the Company were willing to give an undertaking to the satisfaction of the Conservators' solicitor on the lines proposed, and would pay a proper and sufficient price for the land, the Conservators were prepared to sell the same. The Chairman now reported that an agreement had since been arrived at between the Conservancy and the Company, and the former had withdrawn their petition. The Conservancy approved the action which had been taken.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

The pressure for coal of almost every kind continues, and the market is at present stronger than ever. Boats are now coming forward in good numbers, and loading is proceeding normally. But collieries are still experiencing a shortage of output due to a large amount of sickness among the men. Shippers are finding prompt loading turns very difficult to arrange, and in some cases almost fancy prices are being offered for spot lots. Inquiry remains good, and considerable business has been done for April, so that a continuance of similar conditions appears likely for some time to come.

Gas coals have been showing an improving tendency under better demand, and, while prices are not much altered, there is a harder tendency. Wear Specials are firm at 15s. 6d. f.o.b., and best qualities at 15s. to 15s. 3d. Good seconds ask up to 15s. There is still a great pressure for coking coals, and best unscreened sorts easily get 15s. 6d., while even good smalls are worth 14s. 6d. There is considerable shortage of Durham bunker sorts, and best unscreened have been done as high as 16s. 6d. f.o.b.; seconds are quoted at 15s. to 15s. 6d. Northumberland steams are booking business for weeks ahead at good prices, and best screened sorts are quoted steadily at 16s. 6d. f.o.b.

Gas coke continues in good demand, and stocks are being rapidly reduced. For shipment 21s. to 22s. is asked.

YORKSHIRE AND LANCASHIRE.

The stronger inquiry for gas coal, which has been a feature of the Yorkshire and Lancashire trade recently, is maintained. The greater activity in regard to practically all classes of fuel continues, and in spite of extra working at the collieries there is still a great deal of congestion. The home consumption of industrial fuel generally is increasing, and the foreign inquiry is active. Rough slacks are in good request. The demand on export account is strong; but the difficulty of obtaining anything like prompt supplies still exists. This is particularly the case in regard to best large steams and several classes of washed fuel. Merchants complain that they have been unable to get sufficient coal, and that in some cases contract deliveries are behindhand.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports:

South Yorkshire—Hards, Association, bunkers 21s. 9d., export 19s. to 20s.; screened steam coal, export 18s.; washed trebles, export 19s.; washed doubles, bunkers 19s. 9d., export 18s. 6d.; washed singles, export 17s.; washed smalls, bunkers 15s. 9d., export 12s. 6d.; rough slack, bunkers 14s., export 12s.; smithy peas, export 18s. to 18s. 6d.

West Yorkshire—Hartley's (f.o.b. Goole), bunkers 18s. 9d., export 17s. 6d.; screened gas coal, export 17s. 6d.; washed trebles, export 18s.; washed doubles, export 17s. 6d.; washed singles, export 16s.; washed smalls, bunkers 14s. 9d., export 12s.; unwashed trebles, export 17s.; unwashed doubles, export 15s.; rough slack, bunkers 14s., export 10s.; coking smalls, export 10s. 6d.

Derbyshire and Nottinghamshire—Top hards, bunkers 20s. 9d. to 21s. 9d., export 19s. to 20s.; cobbles, export 18s. to 19s.; washed trebles, export 18s. 6d.; washed doubles, export 17s. 6d.; washed singles, export 16s. 6d.; washed smalls, bunkers 15s. 3d., export 12s.; unwashed doubles, export 16s.; rough slack, bunkers 13s. 6d., export 11s. 6d. to 12s.

Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, bunkers 19s. to 20s., export 16s. to 18s.; gas coke, export 20s. to 24s.; furnace coke, export 21s. 6d. to 22s. 6d.; washed steam (Goole, West Yorks.), bunkers 18s. 6d.; (Hull, West Yorks.), bunkers 19s.; (Hull, South Yorks.), bunkers 19s. 3d., export 17s. 6d.

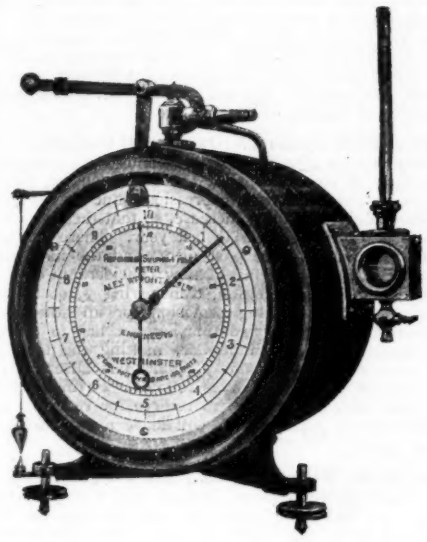
MIDLANDS.

The miniature boom in coal has been unabated during the week. It was created by the long spell of severe weather, and was continued despite the fact that the allocation of the collieries in the Five-Counties Scheme was raised by about 20 p.ct. The difficulties of the collieries and of producers were aggravated by the freezing of canals, which threw extra traffic on the railways. This, in turn, created a shortage of wagons, and deliveries have been greatly in arrears.

The demand for all grades of house coal is maintained at a high level, and the congestion has been partly relieved this week by the re-opening of the canals, though it will take a week or two for the position to right itself. While there is no uniformity in the movement of prices, these are all higher than they were some weeks ago.

Consumption of steams has improved to a considerable extent, and much activity exists in industrials generally, though the stringency is less severe than in the case of domestic fuel. The best qualities of nutty slacks cost around 7s. 6d. to 8s. at the pithead, and lower qualities are priced at about 5s. 6d. Under the influence of a sustained demand "D.S." nuts and slacks are firm at from 12s. to 13s. These are in rather better supply than domestic coal; but there is no great surplus after demand is met, and consumers display some anxiety to get their requirements covered.

METERS



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TRADE NOTES.

New Purifiers for Clitheroe.

The Clitheroe Corporation have placed an order with Messrs. Robert Dempster & Sons, Ltd., Elland, for two purifiers, 25 ft. square by 5 ft. 6 in. deep, worked by means of an 18-in. diameter Weck valve, and complete with superstructure, roof, &c.

Gas Hot Water Equipment.

Messrs. Thomas Potterton (Heating Engineers), Ltd., of Balham, S.W. 12, have issued a pamphlet on their various types of gas hot water appliances. Full particulars of the "Victor" gas boilers are given, together with illustrations and details concerning attractive ranges of "open-fire" boilers.

Steel Mains for Bradford.

The Bradford Corporation Gas Department have accepted the tenders of Messrs. Stewarts & Lloyds, Ltd., Leeds, for steel mains and specials between the Birkshall and Valley Road Gas-Works, at the cost of £4650 8s. 3d.; and of the same firm for jointing by welding of certain steel mains to be laid between the works named.

The "Lancet" Report on Aluminium Ware.

The British Aluminium Company, Ltd., have published a booklet containing the "Lancet" report on aluminium ware. There is a section on kitchen experiments; and the results of cooking various foodstuffs in aluminium vessels clearly show the advantages of cooking utensils of this metal. The Company also announce that they have opened a new branch office and warehouse at Kirkstall Road, Leeds, under the management of Mr. C. F. Batston. The telegraphic address is "Aluminium Leeds," and the telephone number, Leeds 28343.

Solid Injection Oil Engine for Ashford.

A few months ago the Ashford (Kent) Urban District Council equipped their electric generating station with, what was then, the largest solid injection oil engine yet made in this country. This was an 8-cylinder Paxman cold starting "spring injection" crude oil engine, and showed remarkable economical running in practice. As a result, the Ashford Council have just ordered an even more powerful engine of the same type. This second engine will be almost identical with the 1500 b.h.p. engine that the Basingstoke U.D.C. are about to instal for the same purpose.

Further Plant for Primitiva Gas Company.

Messrs. Davison & Partner, Ltd., of Queen Anne's Gate, S.W. 1, have received a further order from the Primitiva Gas Company, of Buenos Aires, to duplicate the 1½ million c.ft. "Davison-Waller" carburetted water gas plant installed by them at the Corrales Works some eighteen months ago. This second unit, in addition to being hydraulically operated like the first unit, will be automatically controlled by a Western automatic controller. The contract also includes a waste heat boiler of the Spencer-Bonecourt "Kirke" patent type, provided with superheater, and capable of working with either set of generating plant.

Gas Boosting and Exhausting Fans.

Messrs. James Keith & Blackman Company, Ltd., of Farringdon Avenue, E.C. 4, have issued a catalogue on gas boosting and exhausting fans, with complete lists of types and sizes for town gas supply. The fans are supplied for any method of driving, but, on direct current supplies, electric motor drive is recommended for the perfect control of outlet pressure, which may be obtained by regulation of the speed. Particulars are also given of exhausting fans for producer gas, which are especially suitable for exhausting gas from the producer plant and passing it at pressure to the engine. The various fans dealt with in the catalogue are particularly suitable for increasing the holder pressure during periods of heaviest demand; for forcing a greater volume through the service mains; or for transferring gas from works holders to storage holders in other parts of the district.

CONTRACTS OPEN.

Gasholders.

The Gas Committee of the Marple Urban District Council invite tenders for a spirally guided gasholder and steel tank or alternatively for a waterless type. [See advert. on p. 761.]

The Hebden Bridge and Mytholmroyd Gas Board invite tenders for the dismantling and removal of a two-lift column-guided gasholder and the supply and erection of a new spiral-guided holder. [See advert. on p. 761.]

Pipes and Specials.

The Marple Urban District Council Gas Department invite tenders for the supply of pipes and specials. [See advert. on p. 761.]

Retorts.

The Bakewell Urban District Council invite tenders for resetting one bed of six retorts, including regenerator furnaces, &c. [See advert. on p. 761.]

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *March* 11.

There is rather a revival of interest in pitch, and the price is firm at about 35s. per ton f.o.b. makers' works.

Creosote is unchanged at about 6¾d. per gallon f.o.b.

Pure benzole is 1s. 11d. to 2s. per gallon; pure toluole, 2s. 1d. to 2s. 2d. per gallon; and 95/160 solvent naphtha, about 1s. 7d. to 1s. 8d. per gallon.

Pyridine bases is about 4s. 3d. per gallon.

Tar Products in the Provinces.

March 11.

There is no change in the market for tar products.

The average prices of gas-works products during the week were: Gas-works tar, 18s. 6d. to 23s. 6d. Pitch—East Coast, 32s. to 33s. f.o.b. West Coast—Manchester, 27s. to 27s. 6d.; Liverpool, 29s. to 30s.; Clyde, 29s. to 30s. Toluole, naked, North, 1s. 7¼d. to 1s. 8¼d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 3¾d. to 1s. 4¼d. Heavy naphtha, North, 1s. to 1s. 0¼d. Creosote, in bulk, North, liquid, 4d. to 4¼d.; salty, 3¾d. to 4d.; Scotland, 4d. to 4¼d. Heavy oils, in bulk, North, 6d. to 6¼d. Carbolic acid, 60 p.c.t., 1s. 10d. to 1s. 10½d. prompt. Naphthalene, £13 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.c.t., purely nominal; "B" quality, unsaleable.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole . . .	1 0	to 1 1	per gallon at works
Motor ,, . . .	1 7	,, 1 8	,, ,,
90 p.ct. ,, . . .	1 9	,, 1 10	,, ,, ,,
Pure ,, . . .	2 0	,, 2 1	,, ,, ,,

New Gasholder for Ballymena.—The Council of Ballymena has approved of the Gas Manager's recommendation to instal a new gasholder, with a capacity of 150,000 c.ft., at the gas-works at a cost of £5000, and has decided to apply for a loan for the purpose of carrying out the work.

Proposed Extensions at Coleraine.—Mr. F. G. M'Ilwee, Gas Manager at Coleraine, Co. Derry, who recently completed a tour of gas-works in England and Scotland, submitted a report to his Borough Council on extensions to the local works, the scheme to cost between £2000 and £2500. The Council, however, thought this outlay would be too heavy, and adopted a modified scheme to cost £950.

Newcastle Company's Year Book.—The 1929 edition of the Newcastle-upon-Tyne and Gateshead Gas Company's Year Book contains some very interesting information regarding the progress of the gas industry in general and in Newcastle in particular. Following a full report of the proceedings at the Annual General Meeting, there are some useful points concerning the service which the Company have to offer to their consumers, and statistics relating to the consumptions of gas in the area since the year 1838. Included also are well illustrated sections on the various uses for gas, both domestic and industrial, together with a few words on the smoke evil in this country to-day. Finally, there is a note on the forthcoming North-East Coast Exhibition, and the gas section thereat; and some excellent illustrations showing something of the general publicity campaign carried out by the Company. The booklet makes most entertaining reading, and is a real tribute to the up-to-date methods of the Company.

Lectures on Gas Meters to Smethwick Employees.—Two lectures to the employees and staff of the Distribution Section of the Smethwick Gas Department were delivered on Tuesday and Wednesday evenings, March 5 and 6, at the Municipal Technical College, Crockett's Lane, under the chairmanship of Mr. E. Hardiker, Engineer and Manager. The lectures were given by Mr. A. T. Gilbert, Southern Manager of Messrs. J. H. Robinson & Co. (Liverpool), Ltd., who commenced with the history of gas meters from the earliest days of the industry and traced the developments and improvements up to the present time. The lecturer, with the aid of specimen sectional apparatus, demonstrated the methods by which the accuracy of registration to meet the requirements of the Board of Trade Inspectors were provided for. The Chairman of the Gas Committee attended the Wednesday evening lecture. After thanking Mr. Gilbert for his excellent lectures, he said he was sure they would be most helpful and instructive to the large number of members present in carrying out their duties.

Coke Oven Gas for Glasgow.—At the fortnightly meeting of the Glasgow Corporation on March 7, the Gas Committee's recommendation was approved that an agreement be entered into for a period of ten years with Messrs. W. Hunter & Sons for a supply of purified coke oven gas, of not less than 3 million c.ft. or more than 10 million c.ft. per 24 hours, the gas to be of a calorific value of not less than 480 B.Th.U.; that the price be 7·2d. per 1000 c.ft.; and that, in the option of the Corporation, the price may be reviewed at the end of five years, regard to be had to the cost of average screened gas coals. Conditions laid down are that the Company provide at their works all necessary plants for purifying and measuring the gas; and that they lay and maintain, at their expense, the necessary mains to convey the gas from their works at Newmains to the Corporation's main at Baillieston. Mr. Walker (Convener of the Gas Committee), in reply to a question, stated that if the project materialized, and they ultimately obtained a maximum of 10 million c.ft. per day, the price of gas in Glasgow may be reduced by at least 6d. per 1000 c.ft.

Bognor Stock Issue.—As will be seen from an announcement appearing in our advertisement pages, Messrs. A. & W. Richards, of 37, Walbrook, E.C., are offering for sale by tender, under the instructions of the Directors of the Bognor Gas and Electricity Company, £35,000 new consolidated stock of the Company, ranking for a maximum dividend of 7 p.ct. equally with the existing similar stock now receiving dividend at this rate. The minimum price of issue will be £102 per £100, yielding at that price £6 17s. 3d. p.ct.

Police Telephone Boxes for Gas Escapes.—The Chief Constable of Newcastle-upon-Tyne has, by arrangement, kindly altered a Police Order so as to permit of the notification by Police Box telephone of escapes of gas. The order now reads as follows: "It is not intended that Box telephones should, as a general rule, be connected through the postal exchange to private numbers; yet in such cases as inquiries at hospitals or other such institutions, calls for doctors, midwives, notification of escapes of gas, &c., inquiries on behalf of anxious relatives, and indeed any other type of call which indicates urgent humanitarian need, exceptions will be made. For such calls no charge will be made if the caller is in poor circumstances, but in other cases the beat constable will subsequently collect the post office call fee of 2d." The Chief Constables of Gateshead and Tynemouth have also agreed to the use of the Police Boxes in their areas for notification of escapes of gas.

Report of the Maryborough (Queensland) Company.—Sales of gas by the Maryborough (Queensland) Gas and Coke Company show a small decrease as compared with the corresponding period of last year, due to the continued trade depression; but against this, residual products show a corresponding increase, so that these two items added together are practically similar to last year. There has been a good demand for coke during the past term, and the large stock which they were carrying in June last is now considerably depleted. After writing off £600 for depreciation, transferring £200 to reserve fund (under Gas Act), and making provision for all other charges, the profit amounted to £1923. To this amount has to be added £548 brought forward from last half-year, making the total amount at credit of profit and loss account £2472. The Directors recommend that this amount be dealt with as follows: Payment of a dividend of 7 p.ct. per annum; transfer to reserve for renewals and contingencies the sum of £520, which will leave a balance to be carried forward of £501.

Report of the Wellington (N.Z.) Gas Company.—The Directors' report of the Wellington (New Zealand) Gas Company for the year ended Dec. 31, 1928, states that the results from the Glover-West plant continue to be highly satisfactory. The reticulation of Ngaio and Kandallah is completed, and the work of laying pipes in Johnsonville is in progress. Twenty-two miles of new mains have been laid and 1756 services connected, while 2577 gas cookers have been fixed—this constituting a record, the previous highest number being 2215 in 1927. There has again been a satisfactory increase in the consumption of gas. After payment of the interim dividends at the rate of 4 p.ct. on the ordinary shares, the year's dividend on the preference shares, providing for depreciation of plant, buildings, and machinery, and also for debenture fund, the balance at the credit of the profit and loss account amounts to £33,768, which it is proposed to appropriate as follows: The payment of a further dividend at the rate of 4 p.ct. (making 8 p.ct. for the year), and to carry forward the remaining balance of £22,616.

Proposed New Showrooms for Blackpool.—The Blackpool Gas Committee having decided that a proposal for the establishment of a central gas showroom be provisionally approved, Councillor H. E. Evans moved at the Town Council meeting that the scheme be not entertained. One was drawn to the conclusion, he said, that the expense, unnecessary and extravagant, was prompted by rivalry between the lighting, heating, and power concerns—gas and electricity. The time had come when further capital should be confined to necessities. Alderman S. Hill said the Electricity Committee had showrooms, but when people wanted to buy apparatus, they were recommended to the private trader. He supposed that the Gas Committee would do the same thing. Councillor W. S. Ashton said the Electricity Committee had no power to sell, but the Gas Committee would have power both to show and sell. Councillor P. J. Tomlinson, the Chairman of the Gas Committee, said a firm was willing to open a showroom in one of the best parts of the town, even if they paid £1000 a year for the premises. The Gas Department felt they had a formidable opponent in electricity, and they wanted to stand on their own feet. The scheme was approved by 19 votes to 17 after an interesting debate.

The output of gas by the Hastings and St. Leonards Gas Company for the month of February shows an increase of 9 million c.ft. over February of last year.

Owing to the extra duties and responsibilities that the Burnley Corporation Gas Engineer, Mr. J. H. Clegg, has been called upon to undertake in connection with the inauguration of the new municipal gas-works at Oswald Street, the Town Council have granted him an honorarium of £250.

The Bradford Gas Committee, having inspected a waterless gasholder being erected for the Edinburgh Corporation by Messrs. Robert Dempster & Sons, Ltd., Elland, are recommending the erection of that type of holder for the carburetted water gas plant in the reconstruction scheme at their Valley Road Works.

It was reported to the Blackburn Town Council, on March 7, that, while the Gas Department felt they were unable to guarantee more than £5000 towards the rates during 1929, in view of the additional cost they might have to meet owing to the increase in assessments, they had undertaken to do their best to increase their contribution to the amount of last year—namely, £10,000.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex Dividend.	Dividends. Prev. Hf.Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Mar. 8.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a.	% p.a.				
171,878	Stk.	Feb 7	5	5	Aldershot 5 p.c. max. C.	70–75	..	..
412,992	,,	..	4	4	Do. 4 p.c. Pref.	73–76	..	74½–75½
1,581,868	,,	Sept. 27	7	7½	Alliance & Dublin Ord.	94–102	..	100½
274,000	,,	Jan. 10	4	4	Do. 4 p.c. Deb.	68–64	..	..
522,625	,,	Mar 7	7	7	Barnet Ord. 7 p.c.	112–116*	–2	1'3/8
300,000	1	Oct 11	1/7½	1/8½	Bombay, Ltd.	20/–22/-	..	21/–22/-
172,500	10	Mar 7	8½	9	Bournemouth 5 p.c.	12½–13½*	–½	..
600,050	10	,,	7	7	Do. B 7 p.c.	12½–13½*	–½	12¾–13
431,150	10	,,	6	6	Do. Pref. 6 p.c.	10½–11½*	–½	11½–11¾
50,000	Stk.	Jan. 10	3	3	Do. 3 p.c. Deb.	55–68	..	..
162,025	,,	..	4	4	Do. 4 p.c. Deb.	74–77	..	..
257,900	,,	Aug. 30	7½	7½	Brighton & Hove 6 p.c. Con.	115–118	..	..
371,580	,,	,,	6½	6½	Do. 5 p.c. Con.	101–104	..	..
1,287,500	,,	Feb. 21	5	5	Bristol 5 p.c. max.	90–91a	–½	..
855,000	,,	Sept. 27	7	8	British Ord.	117–123	..	..
100,000	,,	Dec. 20	7	7	Do. 7 p.c. Pref.	115–120	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	73–76	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	93–96	..	..
100,000	10	Dec. 6	8	8	Cape Town, Ltd.	8–9	..	..
100,000	10	Oct 25	4½	4½	Do. 4½ p.c. Pref.	6½–7½	..	..
180,000	Stk.	Dec. 20	4½	4½	Do. 4½ p.c. Deb.	73–78	..	..
836,860	,,	Feb. 21	6	6	Cardiff Con. Ord.	97–100	..	..
887,860	,,	Jan. 10	7½	7½	Do. 7½ p.c. Red. Deb.	100–103	..	102½–103
157,150	,,	Feb 21	5	6½	Chester 5 p.c. Ord.	87½–92½	..	..
79,185	1	Oct. 11	1/2/-	1/2/-	Colombo Ltd. Ord.	36/–38/-	..	..
24,495	1	,,	1/1/6	1/1/6	Do. 7 p.c. Pref.	21/–23/-	..	..
275,402	1	Oct. 11	1/9½	1/9½	Colonial Gas Assn. Ld. Ord.	24/6–26/6	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	21/–23/-	..	..
2,073,280	Stk.	Feb. 21	5	7	Commercial Ord.	98–101	..	98½–99½
475,000	,,	Dec. 20	3	3	Do 3 p.c. Deb.	56–59	..	57
800,000	,,	Sept. 27	11	11	Continental Union, Ltd.	123–128	+½	122–129
200,000	,,	,,	7	7	Do. 7 p.c. Pref.	123–128	+½	..
187,580	,,	Feb. 21	7	7	Croydon sliding scale	109–112	..	110 111
408,100	,,	,,	5	5	Do. max. div.	82 85	..	..
542,270	,,	Mar. 7	7	10	Derby Con.	112–117e*	–3	..
55,000	,,	Dec. 20	4	4	Do. Deb.	70–72e	..	..
999,000	,,	Mar. 7	5	5	East Hull Ord. 5 p.c.	73–76*	–2½	..
1,009,180	10	Sept. 13	16	14	European, Ltd.	22–24	+4½	19½–25
13,708,480	Stk.	Feb. 21	5½	5½	Gas Light & Coke 4 p.c. Ord.	19/–19/6f	..	19/–19/6
2,000,000	,,	,,	8½	8½	Do. 8½ p.c. max.	64–66*	..	64½
4,157,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	77–80	..	77–78½
5,609,820	,,	Dec. 20	3	3	Do. 3 p.c. Con. Deb.	58–61	..	58½–60½
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	98–101	..	101½
93,500	,,	Aug. 30	6½	7	Hastings & St L. 5 p.c. Conv	95–100	..	97½
350,740	,,	,,	5½	5½	Do. 8½ p.c. Conv.	75–80	..	..
70,000	10	Oct 11	†10	†10	Hongkong & China, Ltd.	13–14	..	..
319,300	Stk.	Mar. 7	5½	6	Hornsey Con. 8½ p.c.	86–89*	–2	..
1,276,000	,,	Nov. 8	10	10	Imperial Continental Cap.	390–410	+5	395–405
322,180	,,	Feb 7	8½	8½	Do. 8½ p.c. Red. Deb.	69–72	..	..
295,242	,,	Mar 7	7½	8	Lea Bridge 5 p.c. Ord.	117–120*	–3	..
2,145,907	,,	Feb. 21	6½	6½	Liverpool 5 p.c. Ord.	93½–94½	..	..
600,000	,,	Sept 27	7	7	Do. 7 p.c. Red. Pref.	102–104b	+1	..
166,788	,,	Feb. 21	9	8	Maidstone 5 p.c. Cap.	124–129	+3	..
63,480	,,	Dec. 20	3	3	Do. 3 p.c. Deb.	54–57	..	..
15,000	5	Dec. 6	18	18	Malta & Mediterranean	5¾–6¼	..	..
322,000	—	—	—	—	Metrop't'n (of Melbourne) 5½ p.c. Red. Deb.	100–102	..	..
941,920	Stk.	Nov. 22	†7	†5	Montevideo, Ltd.	101–105	+2½	..
2,061,316	,,	Feb. 21	5	5	Newcastle & Gateshead Con.	17/–17/9d†	+·/4½	..
682,876	,,	,,	4	4	Do. 4 p.c. Pref.	72½–73½d	..	..
601,705	,,	Dec. 20	3A	3A	Do. 3½ p.c. Red. Deb.	68½–69½d	+½	..
181,780	,,	Mar 7	7/1/0	7/1/0	North Middlesex 5 p.c. Con.	100–105*	–2	..
300,000	,,	Nov. 22	7	9	Oriental, Ltd.	116–120	..	..
184,199	,,	Dec. 20	7½	8	Plym'th & Stonehouse 5 p.c.	108–111	..	..
421,416	,,	Feb. 21	7½	8½	Portsm'th Con. Stk 4 p.c Std.	113–118	..	..
341,445	,,	,,	5	5	Do. 6 p.c. max.	81 84	..	..
2,334,464	1	—	—	—	Primitiva Ord.	33/- 35/-	+·6	34/10½–34/7½
214,500	100	Dec. 8	4	4	Do. 4 p.c. Red. Deb.	91–94	..	..
635,001	Stk.	Jan. 24	4	4	Do. 4 p.c. Red. Deb. 1931	78 80	..	79½–80
416,345	,,	Dec. 20	4	4	Do 4 p.c. Cons. Deb.	78 80	..	80½
150,000	10	Sept 27	6	6	San Paulo 6 p.c. Pref.	8½ 8½	..	..
1,736,968	Stk	Aug 30	—	—	Sheffield Cons.	104–108e	..	..
95,000	,,	Jan 10	—	—	Do. 4 p.c. Deb.	74 77e	..	..
90,000	10	June 14	13	14	South African	4–6	..	..
6,602,895	Stk.	Feb. 21	5	7½	South Met. Ord	106 108	..	104½–107½
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	108–111	..	109½
1,495,445	,,	Jan. 10	8	8	Do. 8 p.c. Deb.	59–61	..	60
784,000	,,	Mar 7	6½	6½	Do. 6½ p.c. Red. Db.	91–101*	–2	102½
91,500	,,	Mar. 7	8½	8½	South Shields Con.	106½–107½d*	–2½	..
1,548 795	,,	Feb. 21	6½	6½	South Suburban Ord. 6 p.c.	107–110	..	..
488,837	,,	Dec. 20	5	5	Do. 5 p.c. Deb.	98–101	..	99
647,740	,,	Mar. 7	5	5	South'mpton Ord. 5 p.c max	76–78*	–2	..
131,275	,,	Dec. 20	4	4	Do. 4 p.c. Deb.	74 75	..	..
350,000	,,	Feb. 21	7	7	Swansea 7 p.c Red. Pref.	100–102	..	101½
900,000	,,	Dec. 20	6½	6½	Do. 6½ p.c. Red. Deb.	100–102	..	..
1,001,275	,,	Mar. 7	—	6½	Tottenham District Ord.	100–103*	–2	102½
140,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	95–98*	–2	..
191,255	,,	Dec. 6	4	4	Do. 4 p.c. Deb.	75–78	..	..
259,894	,,	Mar 7	6¾	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	98–98*	–2	..
98,380	,,	,,	5	5	Do. 5 p.c. pref.	85–90*	–2	..
90,000		Feb 21	8½	9	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	147–152	..	..
155,638	,,	,,	7½	7½	Do. B 8½ p.c.	125 130	..	..
451,535	,,	,,	6½	6 7/10	Do C and New	102–107	..	103
353,000	,,	,,	7½	7½	Do. Wimbledon 5 p.c.	115–120	..	117
96 000	,,	,,	7½	7½	Do. Epsom 5 p.c.	155–160	..	..
230,000	,,	,,	5	5	Do. 5 p.c. Pref.	90–95*	..	..
48 416	,,	Dec. 20	8	8	Do. 8 p.c. Deb.	57–60	..	..
184,748	,,	,,	4	4	Do. 4 p.c. Deb.	77–80	..	..
377 500	,,	,,	5	5	Do. 5 p.c. Deb.	97–100	..	..

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CONTENTS.

EDITORIAL NOTES.

The Victim of Isolation 789
To the 150-Million C.Ft. Undertaking . . 789
The Limitless Field 790
Rationalization of Industry—Numbering of Shares—A Reflection on Water Pipes—And on Gas Fires 791

Personal 791
Obituary 791
Forthcoming Engagements 791
National Gas Council—Central Executive Board 792
Gas Stock and Share Market 792
Southern Association of Gas Engineers and Managers—
Luncheon 793
Business Meeting 794
Modern Horizontals at Devonport. By F. Blackburn, Assoc.M.Inst.C.E. . . . 795
The Institution Education Scheme . . . 795
Presidential Address of Mr. W. E. Dean . 799
"W-D" Continuous Vertical Retorts—Striking Figures: Flexibility and Maintenance Costs 797
Fuel Developments and the Training of Fuel Technologists 797
Survey of the Parkgate Coal Seam of the South Yorkshire Area—Reviewed by M. Barash, M.Sc. (Tech.), A.I.C. 797
Coke for Steam Generation 798
Lancashire District Tar Board Conference with Surveyors 798
London and Southern District Junior Gas Association—
Visit to the James Keith & Blackman Company's Works 804
Western Junior Gas Association—
Visit to Stroud Gas-Works 805
A Few Facts on Gas *versus* Electricity. By C. Bateman 805
Mr. F. W. Goodenough on Salesmanship—Increased Efficiency Needed 806

REGISTER OF PATENTS.

Wet Meters—Parkinson & Cowan, Ltd., and Thorp, F. 807
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Baffles—Gas Light and Coke Company and Clark, J. G. 808
Applications for Patents 808

PARLIAMENTARY INTELLIGENCE.

House of Lords—
Gas Undertakings Bill 809
Private Bills 809
House of Commons—
Compensation for Street Explosions . . 809
Gas Undertakings Bill 809

MISCELLANEOUS NEWS.

European Gas Company, Ltd.—Annual General Meeting 810
Sheffield Gas Company—High Pressure Mains and Bulk Supply 812

MISCELLANEOUS NEWS—(*continued*).

Gas Regulation Act Applications 812
The Bloomsbury Explosion—Concluded Inquest on Post Office Linesman 813
Gas and the Community—Address to Enfield Rotarians 813
Gas Charges at Stockton 813
Coke Ovens to be Erected near Leeds . . 813
Fire at Manchester Gas-Works—Official Statement 814
Bungalow Tragedy at Birmingham—Death Caused by Blocked Flue 814
Barcelona International Exhibition . . . 814
Gas Companies' Results in 1928—A General Increase of Business 815
Coal Trade Reports—
North-East Coast 817
Yorkshire and Lancashire 817
Midlands 817
Current Sales of Gas Products 818
Trade Notes 818
Contracts Open 818
Stock and Share List 819

PARAGRAPHS.

Index to British Standard Specifications . . 796
Benzol and By-Products, Ltd., Report . . 798
Proposed Purchase of Llandrindod Wells Company 808
Blackpool Gas Department Estimates—Rugby Stock Issue—Bussey Distillation Plant at Glenboig—Chesterfield Gas Undertaking—Cleveland Institution of Engineers—Portsmouth Social and Athletic Club Meeting 814
Bombay Gas Company Report—Radiation Limited—Reduction in Price at Peebles—Presentations to Wellington Employees—Gibbons (Dudley), Ltd.—Further Chandelier Accident—Buxton Not to Relieve the Rates this Year—Bournemouth Co-Partners' Meeting 818

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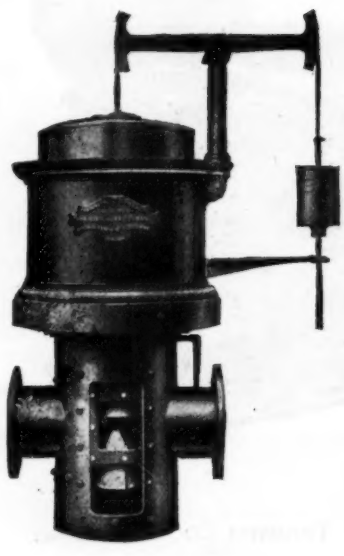

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